Need of Water Power Developments*—*Calculation of Reactors, Coupled Arc Lamps, and other technical and commercial articles.

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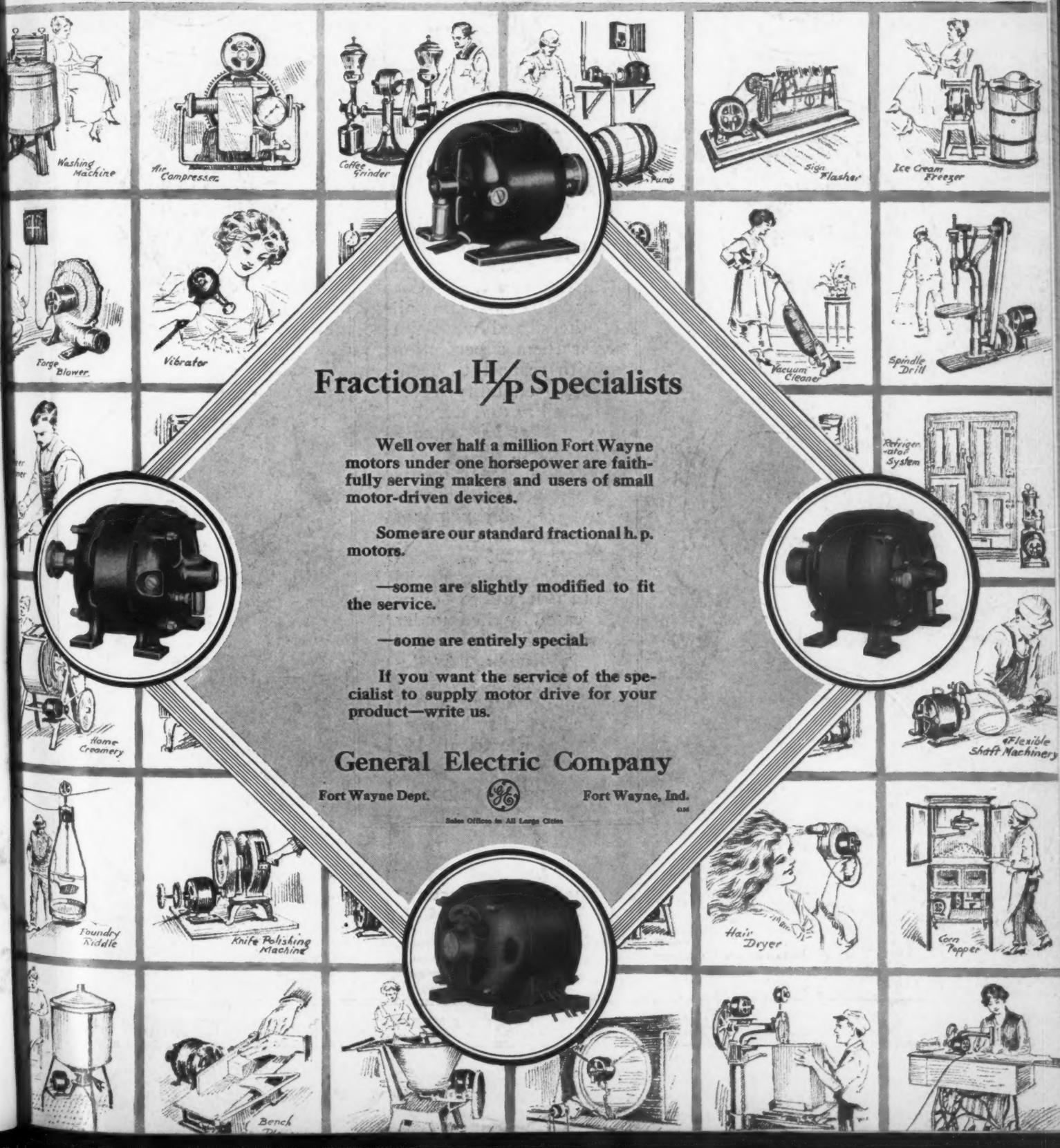

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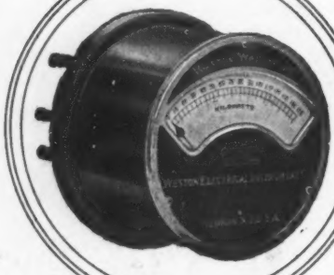

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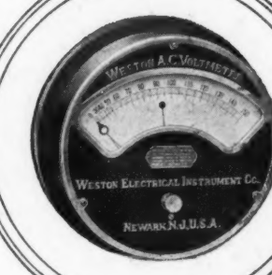

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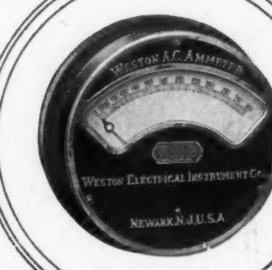

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Weston Electrical Instrument Company

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Conference on Water-Power Development

TWO excellent conferences on water-powers were held in Washington this week. Both should go far to clarify thought and action on water-power legislation in the present congress. As a purely disinterested and technical body the American Institute of Electrical Engineers has done the nation a service and brought honor to itself in having its best men discuss the development of our water-powers from all angles. They show that the fault does not lie with private enterprise if the water-powers are running to waste. Economic conditions heightened by restrictive legislation have militated against water-power development and encouraged the unnecessary consumption of coal in less costly yet more profitable steam stations. Remove the fetters, give willing hands the right to work, the right to build, expand and develop, and the engineers will create a greater and more powerful industrial nation. Of this there can be no doubt. No other proof is necessary than that furnished by the electro-chemical engineer. As a full-grown and lusty youth he disdains a diet for babies. He craves for sustenance commensurate with his growth and needs. His industry is vitally essential to the other manufacturers of the country, yet is stunted in its growth for lack of electric power. Can anything be more convincing or to the point than his righteous wrath over conditions at Niagara? He thirsts for the power at his door, but the government will not suffer him to drink. Small wonder that he rails at governmental inefficiency and inaction. All his dreams, his ambitions, his genius are shattered because he cannot get sufficient dependable and cheap power to give them play, and this through no fault of his own. With the load factor the chemical industries furnish only water-power can fill his wants, and that he cannot get. Not all legislators are blind, however, and there are indications that those totally blind are beginning to see light. Certainly the conferences just closed should furnish facts that will open their eyes.

Influence of the War Upon Materials

IN war all calculations are subject to failure. If some electrical engineer had predicted, say, five years ago that zinc would be used industrially in conductors among any of the civilized nations of the world, he would have been regarded as a fit subject for a commission of insanity. Yet the reports published from German sources on page 984 of this number indicate that zinc is being so used by the central European powers to-day. The moral of the story, apart from its technical interest, is manifestly that occasionally in the affairs of men the unthinkable becomes the fact, and that mental reservations should always be made for unforeseen cataclysms.

It has to be remembered that the central European countries are, and have been for many months, besieged. They are surrounded by a barbed-wire fence on land and by a patroling fleet at sea. The fence is some 400 miles long on the western border, from Nieuport to Belfort, and some 800 miles long on the eastern border, from Riga to the Danube's mouth, to say nothing of sections in Asia Minor. Along all these lines men stand almost elbow to elbow in the trenches.

It is therefore no wonder that certain materials should run short in the besieged area, especially a metal like copper, which, in shell linings, is being steadily thrown out over the dead line at the average rate of many tons daily. The relative commercial disadvantage of any given metal as an electric conductor, assuming that it is practically capable of being used and worked, is the continued product of its resistivity, its specific gravity, and its cost per unit of weight. Copper at one time held all other contestants at a distance by reason of the smallness of this product. In more recent years aluminum and, for some purposes, steel have come into competition with copper, but zinc never, it would seem, until now. A few years ago it was half seriously proposed to try sodium in cast-iron tubes as a substitute for copper, but the difficulties and dangers of the plan apparently deterred its advocates from continuing their trials.

A One-Man Generating Station

THERE have been many calls for a thoroughly foolproof and practically automatic electric generating station capable of giving the maximum of service with the minimum of attention. Such a station is obviously extremely useful for isolated plants and for central distributing plants of small output. There have been some interesting examples of such practice when water was the source of power, but very few instances of attempting practically automatic operation with any other prime mover. The little station at Thompson, Iowa, which we describe in another column, is a most instructive example of the extent to which automatic operation can be carried in case of need. The town has but 431 inhabitants, and it was desired to give twenty-four hour service. It is quite clear that a system for a place of this size should be essentially a one-man affair, which it actually is in virtue of a singularly ingenious automatic equipment. The generating outfit is positively imposing in its microcosmic magnitude,

consisting of two 17-kw., 220-volt, three-wire, d.c. generators, each driven by a 28-hp. oil engine, and provided with a balance and booster set and with a storage battery to tide over the times of lightest load and presumably to give the operator a chance for a bite and a nap.

The really striking feature of the plant is not its diminutive size, but its almost completely automatic operation. When the demand is very small the battery does the whole work. If the load rises above a predetermined point or the battery becomes too nearly discharged, one of the oil engines is started automatically by means of the battery driving the generator as a motor, and when in action goes to work helping out the battery and recuperating its charge. If at times of greater demand the call for current exceeds the comfortable capacity of one generating set, the other is in a similar way automatically started up and shut down again when the need for current diminishes. A special relay is provided to ring in an alarm in case the engine for any reason fails of ignition, and finally, in case of last resort, to cut out the battery lest it be overdischarged. When the battery is at suitable charge and the demand too small to make it reasonably economical to operate even one generator the engine is automatically shut down. The little plant not only lights the town, but also provides the motor service, including pumping for the town water supply.

Those of our readers who are interested in small plants—and they are many—will find in the details of the equipment here described much that is of practical interest as showing how thoroughly automatic action can be carried out by means of appliances now available. One can imagine that an equipment of this kind might prove extremely useful, for example, in case of lighting a summer hotel, a large country house or in many situations where attendance would ordinarily be an important item in the cost of operating the plant. The example before us is certainly as completely automatic in its functioning as one could wish.

The Identification of Cables

THE plan worked out by the Edison Electric Company of Brooklyn for the marking and identification of its feeders and cables should appeal with special force to companies operating underground systems. The distribution concerned has to deal with cables of many classes, 6600-volt three-phase, 240-volt d.c. three-wire, and 2400-volt two-phase, besides pressure wires and arc circuits. The plan in brief is to give a serial number for each cable, which immediately tells what it is and where it is running. For instance, the three-phase feeders all have numbers between 5000 and 10,000, the first digit designates the plant from which the feeder runs and whether it is a direct feeder or a tie feeder between substations. The second and third digits show the substation or the customer connected with this particular feeder, and the fourth the specific number of the feeder between the points given by the first three digits. Direct-current cables are numbered on a similar principle, the neutrals being specially tagged to indicate that fact. The two-phase feeders are each tagged with the name of the chief street fed, thus sufficiently designating them and making their identity at once clear, which is particularly important, as they are worked upon when alive, both overhead and underground. Pressure wires are so tagged, and arc feeders are given somewhat arbitrary numbers, the first digit of which indicates the number of the station from which the circuit proceeds. Each kind of feeder has a distinctive tag, so that with very little experience the identity of any particular cable is at once established. The plan as worked out seems to be a very efficient one, and is easily applied to any system, large or small. Also, it eliminates entirely the difficulties which sometimes arise where a cable system has gradually grown up in determining with certainty which particular one of the many cables in a manhole requires attention.

Rebate Coupons for Lamp Renewals

COMPARATIVELY few stations, especially of the smaller sort, can afford the luxury of entirely free lamp renewals. Where free renewals have been tried some very ingenious schemes for beating the game on the part of the consumers have sometimes been unpleasantly in evidence. Various schemes for renewal charges on lamps, or certain sizes of lamps, have been resorted to, sufficient to relieve the company of unnecessary expense and at the same time to give the consumer high-grade lamps at a very reasonable figure. The method worked out in one plant described by Mr. Borden is a comparatively simple one, which seems to overcome some of the more common difficulties of adjusting the matter of renewals in cases where free renewals are undesirable. Briefly, rebate coupons, applicable to payment of the electric light bill, are given to any consumer who brings back a lamp for exchange. The new lamp is nominally sold at a very moderate figure above actual cost to the company and paid for. The coupons constitute a large item of rebate, the amount given depending on the price of the lamp taken, ranging from 5 cents for the smallest lamps up to $5 for the 1000-watt size. The amount of the coupons at face value is such that the company stands by far the largest part of the renewal, so that the consumer has every reason to approve the arrangement, and besides is certain of getting, on very favorable terms, the best grade of lamps. The amount of the coupons given seems to be based on producing a fairly uniform discount, ranging generally from 4 per cent to 5 per cent on the energy used by the lamp concerned, the base price being taken at 10 cents per kilowatt-hour. The schedule is arranged to take care of all kinds of lamps, whether metallic filament or not. The delivery in case the consumer does not call for lamps is charged extra. No renewals are given except through the coupon system, and the total of the canceled coupons gives an immediate check on the lamp renewal account. The plan seems to lend itself very well to the use of stations having contract customers, or using the extremely simple methods of accounting.

Electromagnetic Units

THE science and art of metrology, *i.e.*, the measurement of physical quantities of the apparent universe in simple, logically connected units, are manifestly in a very backward state, despite their great theoretical and practical importance. All the civilized nations, for instance, divide a circular arc into 360 degrees, or 21,600 minutes, or 1,296,000 seconds, a beautiful arithmetical tangle. Likewise, they all divide a civil day into twenty-four hours, or 1440 minutes, or 86,400 seconds, another example of how to make simple concepts hard to deal with quantitatively. Most of the civilized nations have adopted the metric system, which is a haven of intellectual rest and simplicity, as regards measures of length, mass, area and volume, but a few still cling to a medley of measures worthy only of the inexactness of paleozoic man.

From such a basis of chaos and complexity, transition to logic and simplicity can only be expected to be effected by dint of much labor and many small steps. It would not be reasonable to look for a complete and sudden upheaval from primitive confusion to scientific definiteness. Our international system of electromagnetic units is based on the metric system, and is a vast improvement upon pre-existing units in the same field, but it nevertheless leaves much room for further advance in bringing science and practice nearer.

There are three recognized defects in the international volt-ampere-ohm system of units. The first is that they are divorced from the fundamental C. G. S. units of electromagnetic science by a set of decimal factors, such as 10, 10^7, 10^9, etc., which tend needlessly to keep the pure and applied sciences apart. The second is that both it and the fundamental system are confused by what Heaviside described as irrational 4π factors, owing to an unfortunate selection of fundamental definitions, which experience revealed too late for removal. The third is the remarkable and anomalous fact that each and every electromagnetic unit in the fundamental C. G. S. system has a twin, so that the units run two by two, like the creatures entering the ark in the conventional history of the pristine flood. Thus the C. G. S. unit of electromotive force is one-hundredth of a microvolt in the magnetic system, and also 300 volts in the electric system. This duality indicates that there is something radically wrong with the whole structure. Electromagnetism should recognize one and only one fundamental unit of each particular quantity.

The problem of the present day is, therefore, how to conserve what is sound and useful in the existing international electromagnetic system, which has been evolved with so much pains and labor, while at the same time eliminating that which is needless, erroneous, or cumbersome. There is much hope illuminating the path in this direction.

We printed in last week's issue the abstract of a translation of an interesting paper presented not long since by Dr. M. Ascoli to the Italian Institute of Electrical Engineers. This paper points out very clearly the defects of the systems of electromagnetic units, and indicates measures which are capable of being taken for their removal. It is needless to say that when such procedure is adopted it can only be effectively adopted by international action, among physicists, chemists and engineers.

Reactor Design

THE problem of reactor design is of considerable industrial importance, because the reactor has come to occupy so important a part in the generation and in the distribution of power. In the early days of electric lighting by direct current, feeder regulators, in the form of large resistors, were frequently employed to assist in equalizing the potential distribution over the network of mains. These resistors were, later, completely eliminated from such systems, and have already become almost forgotten. They were very bulky, destructive of energy, and were in danger of being accidentally overheated. The reactor consumes but little energy, and does not, therefore, have to be built for power dissipation. The central station reactor has already become fairly well standardized. The smaller types of reactors are nearly all ironclad. This economizes space and material, but the leakage reactance of the magnetic circuit introduces complexities into the design.

Engineers who specialize in the problems of reactor design develop formulas based on their own experience, and these are frequently more or less empirical. The article by Shiro Sano, which we print this week, enters at some length into the magnetic-circuit calculation, and by making reasonable simplifications in assumptions arrives at some interesting practical formulas for a particular type of magnetic circuit. The curves giving a comparison between observed and computed exciting current indicate a satisfactory degree of conformity.

The Coming Issues

NEXT week, in the first or public-relations issue for May, an article of combined engineering and civic interest will point out some of the advantages of combination-utility plant operation in a small community. Contractors, dealers, jobbers and central station men will find helpful testimony concerning the value of co-operation, in the story of the practical adjustment and solution, by this means, of what was formerly an unhappy situation in the retail appliance trade in a Middle West City. The manifold uses of electricity in a modern public market will be described in the same number, which will also present a discussion of the economics of rural electricity supply, as one manager sees the problem after experience with such service in a thrifty farming district. There will also be special articles for the engineer and the operating man, and the progress of the electric range and electric cooking will be closely followed in this and later issues. The station operating number, dated May 13 will include a leading article on electrical smoke and dust precipitation, with details of designs for apparatus for increasing the effectiveness of the method. The N. E. L. A. convention issues will be presented on May 20 and 27.

Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

Philadelphia Rate Case Settled

Reductions Made in Electric Company's Rate Schedule Which Are Expected to Decrease Earnings By More Than $1,000,000 a Year

New rates for electric light and power in the city of Philadelphia have been formulated as a result of the compromise effected early in March (reported in the ELECTRICAL WORLD of March 18) whereby the Philadelphia Electric Company agreed to a reduction of $1,000,000 in its gross earnings for service to the city and other customers, based on the earnings of last year.

The total saving to the Philadelphia public at the new rates is estimated at $1,050,000, of which about $900,000 will be the share of the small consumers. The city will get a reduction of $180,000 on its street lighting bill for 1916 and a rebate of $150,000 on its bill for 1915.

The new rates take effect as of April 1, and will be conditioned by the saving to the city and customers of $1,050,000. The Public Service Commission in its approval of the rates concludes that: "The complaint be deemed satisfied and the above case closed, provided that the said intended reduction of $1,050,000 be in fact accomplished to the satisfaction of the commission."

A statement has been issued by the Philadelphia Electric Company presenting a comparison between new rates and old rates. It says:

"The reductions in the new rate schedule are so apportioned that the greatest benefit inures to the small and average users of commercial light and power and residence light and power, particularly the customers in the residence class who are now paying less than $10 per month.

Greatest Reduction to Residence Customers

"In comparing the old rates with the new, we find that the residence service rate, designated as Rate A, will yield, perhaps, the greatest reductions. Under the new rates, which are uniform for both alternating and direct-current districts, the base rate is 9 cents per kilowatt hour, which is an immediate reduction of 3 cents per kilowatt hour in the direct-current district and 1 cent per kilowatt hour in the alternating-current districts. This, however, is the least of the advantage of the new rate, because this rate of 9 cents only applies to the first twelve or less kilowatt hours used in a month and then for the next 75 units or less used in a month the rate drops to 7 cents per kilowatt hour. All energy used in excess of 87 kw.-hr. a month is billed at 5 cents per kilowatt hour.

"The great advantage of this residence rate is that anyone paying more than $1.08 per month for light is enabled to use all the various household labor-saving devices, vacuum cleaners, washing machines, the smaller cooking devices and every other appliance which is electrically operated in the home, at the low rate of 7 cents and 5 cents per kilowatt hour. A radical step has been made in naming a rate such as this for residences, inasmuch as in order to take care of the small user and to enable him to step down quickly to a low rate connected or demanded load has been ignored, and 12 kw.-hr. per month has been fixed as the small amount of energy which is to be paid for at the highest rate of 9 cents. The minimum charge, also, has been reduced from $1 per month in the alternating-current districts and $3 in the direct-current district, to 75 cents per month.

Second Largest Reduction in Retail Lighting

"The retail lighting service rate, available for any customer using the company's standard service for commercial lighting purposes, and designated as Rate B, obtains, next to the residence customers, the largest share in this reduction. Under the new rate, 9 cents per kilowatt hour is charged for energy used equivalent to or less than the first sixty hours per month of the assessed or measured maximum demand; for the next sixty hours use per month 6 cents per kilowatt hour is charged, and for all in excess of 120 hours use per month, the rate is 3.5 cents per kilowatt hour. The maximum demand is assessed at 70 per cent of the installed load in kilowatts.

"On the other hand if any customer has a connected load of an equivalent of thirty 50-watt lamps or greater and is not satisfied with the assessed demand of 70 per cent, he may have a maximum demand meter installed by paying a maintenance charge of 75 cents per month over and above the charge for energy. The minimum charge in both districts irrespective of the installation is $1 per month. This enables even the very smallest stores to use electric service with easily-demonstrated economies over other lighting methods, and means an appreciable deduction over the old rates for the small and average users.

Retail Power Rate 8.5 Cents

"The new rate for retail power service, available for any customer using the company's standard service for power, is known at Rate C. Under the new schedule, the highest rate is 8.5 cents per kilowatt hour. The difference between 8.5 cents and 9 cents, the highest rate for lighting, is due to the fact that there is no lamp service under power schedules and the difference of ½ cent per kilowatt hour is the cost of this service. This power rate, similarly to the commercial lighting rate, is based on the maximum demand principle whether the maximum demand be assessed and measured. If assessed the maximum demand will be equal to a percentage of the installed load in kilowatts—the percentage varying, according to different conditions, from 85 per cent to 55 per cent of the installed load.

"Moreover, in addition to the above provision is made for measuring the demand if the customer is not satisfied with the assessed demand, in which case a maintenance charge of 75 cents per month, in addition to the energy charge, must be paid by the customer for the maintenance of the maximum demand meter. The new rate is 8.5 cents per kilowatt hour for energy used equivalent to or less than the first sixty hours' use per month of the maximum demand; 5.5 cents per kilowatt hour for the next sixty hours use per month of the maximum demand, and 3 cents per kilowatt hour for all energy used in excess of 120 hours use of the maximum demand. The minimum charge under this rate is 50 cents each month per horsepower installed, subject to a monthly minimum charge of $1.

"The new rate for wholesale light and power service, known as Rate D, has been changed from a quantity

rate, based on varying minimum yearly guarantees—these guarantees varying from $600 minimum per annum to as high as $40,000 minimum guarantee per annum—to what is known as block rate; the minimum charge under the new rate being $50 per month. The first 250 kw.-hr. per month, for light and power, are billed at 9 cents per kilowatt hour for light and 8.5 cents per kilowatt hour for power. Succeeding blocks of 750, 1000, 1500 and so, up to a total of 85,000 kw-hr. per month, are billed at gradually reducing rates, until all in excess of 85,000 kw.-hr. per month are billed at 2 cents per kilowatt hour for light and 1.5 cents per kilowatt hour for power. While this new rate does not lower the charges to any considerable extent for this class of service, it is, however, much simplified and the terms, particularly as to minimums, are more easily complied with.

RATES FOR POWER FROM 11 UP TO 100 HP. ALSO REDUCED

"The new rate for power service, from 11 to 100 hp., known as Rate E, furnishes a reduction over the old rate for corresponding service. The new rate is divided into two parts: a stand-by charge of $3.25 per month per kilowatt of connected load, plus a current charge of 2 cents per kilowatt hour—the latter charge being subject to discounts as the connected load increases above 22 kw., this discount amounting to 20 per cent when connected load is 42 kw. and 31 per cent when connected load is 75 kw. or 100 hp. The minimum charge under the new schedule is $4.25 per kilowatt installed, subject to the above discounts.

"The rates named herein are those principally affected and they, in connection with the rates contained in the previous tariff which have not been affected, plus two or three new rates, make up the new tariff. The new rates mentioned have been designed to take care of certain peculiar characteristics which have arisen in the matter of large power loads."

Dr. Steinmetz on Illumination

Dr. Charles P. Steinmetz, president of the Illuminating Engineering Society, gave a masterly address on "The Progress of Illumination" at a meeting of the New England Section of the organization in Boston, Mass., April 13. After tracing the progress of lighting and illuminants Dr. Steinmetz pointed out the possibilities for making further improvements in the incandescent lamp.

A possible improvement in efficiency would be by reducing the energy loss by heat conduction and convection through the employment of a gas of less heat capacity and of lower heat conductivity than in present practice. Hydrogen gas would require the supply of more power per candle-power than at present, nitrogen gas is fairly good, but argon is still better, having a lower heat loss than nitrogen. Argon is used extensively in the smaller units, and so far nothing more suitable has been found. The efficiency might be increased by raising the gas pressure, but the objection to this is that one soon arrives at a point above atmospheric pressure, when the danger of explosion becomes serious. The 0.5-watt gas-filled lamp runs not far from the melting point of tungsten. If it were practicable to produce light from melted tungsten one would no longer be dealing with an incandescent lamp.

A material having a greater melting point than tungsten would be of no small importance in developing a lamp of increased efficiency. What is desirable is a substance whose maximum radiation occurs in the middle or visible portion of the spectrum. If a material could be found which could be run at 5500 deg. C., the luminous efficiency would range between 10 and 15 per cent.

If carbon could be run as close to its melting point as is tungsten, it would be possible to secure an efficiency of about 1/7 watt per candle-power. Carbon has an abnormally high vapor temperature, however, which results in blackening of the bulb. Different forms of carbon, however, have different vapor temperatures, and a carbon deposited from a hydrocarbon vapor might be operated with less blackening and very close to the efficient maximum of black body radiation, which is about 10 per cent. It is possible that research in carbon produced from organic material may lead to the formation of a carbon molecule of low dissociation, which theoretically could be run near the melting point of the element, thus serving as a more efficient incandescent illuminant than the material which at the present time is available.

SELECTIVE RADIATION

Other possibilities seem to lie in the study of selective radiation, though the gain to be expected is comparatively small. The art needs a radiator in which most of the energy is expended in the visible spectrum, if such can be found. It is theoretically possible to find a substance in which the spectral radiation is practically 100 per cent efficient—in which most of the lines are in the visible range, the substance being weak in lines in the invisible portion of the spectrum. Only three elements, titanium, mercury and calcium, are good from the standpoint of spectral radiation. Spectral radiation in an element varies with the conditions, such as temperature and energy density. With variations in conditions new lines appear and change their proportion in the visible range. Iron, for example, has a very large number of spectral lines over the whole range. It gives a white arc and has a fair radiation efficiency. If the energy density is greatly increased, say instead of from 2 to 3 amp. to 200 to 300 amp., by condenser discharge, superheated iron vapor results, the proportion and distribution of lines changes and the visible spectrum suffers loss of lines owing to the massing of more energy in the ultra-violet and consequently invisible region. With mercury an increase in red and orange lines follows increase in energy density.

LAMP EFFICIENCY MAY BE DOUBLED IN NEXT DECADE

Future progress rests largely upon the probability of getting most of the lines in the visible portion from an element having a small number of total lines. Where there are great intervals between the lines there is more likelihood of getting more lines in the visible portion by changing the conditions. Titanium is a most efficient radiator, but it has thousands of lines scattered all through the spectrum. Something may be done in using very volatile titanium compounds. There is no theoretical limit to the possible efficiency of spectral radiation, but the field is both vast and difficult. Lamp efficiency may perhaps be doubled within the next ten years, but the great gains of the past decade are unlikely to be repeated.

In conclusion, Dr. Steinmetz emphasized the great importance of efficient distribution and pointed out how waste in this field tends to minimize the gains secured through high intrinsic filament efficiencies. He advocated the avoidance of too great uniformity in distributing luminous flux in view of the value of a shadow and background in many applications. A proper proportion between local and general illumination is essential to a well-designed installation in many cases. The greatest advances of the immediate future are to be anticipated in the field of applied lighting, which is the province of the illuminating engineer.

Nations of Europe Encourage Water Power Development

France and Italy, spurred on by the high prices and limited quantities of all kinds of fuel, particularly coal, are giving attention to the undeveloped water powers which for centuries have run to waste. The "white coal" of Europe is receiving more attention to-day than ever before, and the governments are lending every aid to the development of these natural resources.

France, the water power of which is estimated at 9,000,000 hp. to 10,000,000 hp., must import almost all of the coal consumed within her borders. The war, however, has closed almost all of the former sources of supply, and on the other hand has created an unprecedented market for power. Within a short time it was found that the available energy supply was decidedly inadequate, and attention was then called to the necessity for a further development of the nation's available water power.

Several plants of the Alps and of the Pyrenees have completely transformed their equipment in view of the manufacture of the munitions required by the war administration.

Measures have been taken with the view to bringing about the rapid completion of certain factories in course of construction. In the Massif Central several waterfalls of rather great importance have been disposed for this purpose. These various measures have already obtained for the national defense an increase of energy which will shortly reach 60,000 hp. at least.

Already some important industrial establishments which until now only consumed coal, have begun to utilize hydroelectric power. This is notably the case of a great steel works of the Loire which, at present, transmits to its shops electrical energy coming from the Alps.

Thus, the utilization of the waterfalls, which at the present time renders such precious services to the defense of the territory, appears to be destined to play a great part in the resumption of industrial and agricultural activity.

ITALIAN GOVERNMENT URGES DEVELOPMENT

Efforts are being made by the Italian government to extend as far as possible the use of water power for the production of electrical energy in substitution for coal, for the supplies of which Italy is entirely dependent on importation. Under present freight conditions, which have forced up the price of coal to an almost prohibitive level, the matter has become one of urgent importance. On Jan. 16 a decree was issued authorizing the Ministry of Finance to extend concessions for the diversion of public watercourses without the formality of submitting the question to technical authorities for report, provided always the rights of third parties were respected.

A second decree, issued on Jan. 25, defines as follows the conditions under which such extensions can be granted: "When an increased diversion of water is required to provide power for munitions factories, electric railways or other public services, or in important industrial centers threatened by shortage of coal, which is likely to interfere with the utilization of water for purposes of minor importance, the extension may still be granted, under obligation, however, to furnish electrical power in substitution for the hydraulic power which may be interfered with by the extension, and also to provide the technical machinery necessary for such transformation of power."

Provision is made for linking up different plants in order to regulate variations of power obtained either during certain hours of the day or during different periods of the year. Procedure for obtaining extended concessions and authorizations is simplified. Expropriations are facilitated by granting to the local prefect authority to declare them of public service. Provision is also made in the decree for the electrification of the state railways, and the confirmation of old water rights. This decree does not apply to new enterprises to which existing regulations are still applicable, but, in respect of these, modifications are under consideration by the government.

Milo R. Maltbie to Be New York City Chamberlain

Mayor Mitchel of New York City has appointed Milo R. Maltbie, former member of the Public Service Commission, to be city chamberlain, succeeding Henry Bruére. In a statement the Mayor said: "In inviting Mr. Maltbie to take this office I have had in mind securing for the city an expert and adviser in public service matters. For the remainder of the present administration I wish to give especial attention through the agency of the Chamberlain's office to those public-service matters in which the city has a direct interest and in which the law gives the municipality a right to take active part. In other words, in addition to the regular work of the Chamberlain's office, I hope to have Mr. Maltbie give special and constant attention to public-service matters."

More Space Secured for N.E.L.A. Convention Exhibit

The exhibition committee of the National Electric Light Association has announced that additional exhibition space has been secured for the Chicago convention exhibit on the second-floor foyer of the Auditorium Theater. Plans of this new exhibit space are now being prepared and will be sent to manufacturers whose requests have been received, and to any other manufacturers who may desire space. The registration booth and the rooms of the Chicago local committee have been moved to the second floor to make additional room for exhibits.

The committee announces that even with the additional space secured the space will be limited, and suggests that manufacturers who are thinking of making an exhibit send in their requests at the earliest possible opportunity.

A list of the Class D members who have been assigned space up to the present time follows:

Albert & J. M. Anderson Manufacturing Company
American Electrical Heater Company
Anderson Electric Car Company
Bates Expanded Steel Truss Company
Delta-Star Electric Company
Detroit Fuse & Manufacturing Company
Duncan Electric Manufacturing Company
Edison Storage Battery Company
Electric Storage Battery Company
Electrical Record
Elliott-Fisher Company
ELECTRICAL WORLD
Electric Service Supplies Company
Electrical Review Publishing Company
Edison Lamp Works of General Electric Company
Federal Sign System (Electric)
General Vehicle Company, Inc.
General Electric Company
G. & W. Electric Specialty Company
Hurley Machine Company
H. W. Johns-Manville Company
Hotpoint Electric Heating Company
Hughes Electric Heating Company
Hubbard & Company
Hoover Suction Sweeper Company
Life Saving Devices, Inc.
Landers, Frary & Clark
Metropolitan Engineering Company
Moloney Electric Company
National Lamp Works of General Electric Company
Powers Accounting Machine Company
Pittsburgh Transformer Company
Philadelphia Storage Battery Company
Sangamo Electric Company
Standard Underground Cable Company
Schweitzer & Conrad, Inc.
Tabulating Machine Company
Ward Motor Vehicle Company
Walker Vehicle Company
Wagner Electric Manufacturing Company
Western Electric Company, Inc.
Westinghouse companies

The Water-Power Conferences at Washington

Pointed Discussions on Engineering and Governmental Aspects of Hydroelectric Development in the United States, at Meetings under Auspices of A. I. E. E. and American Electrochemical Society

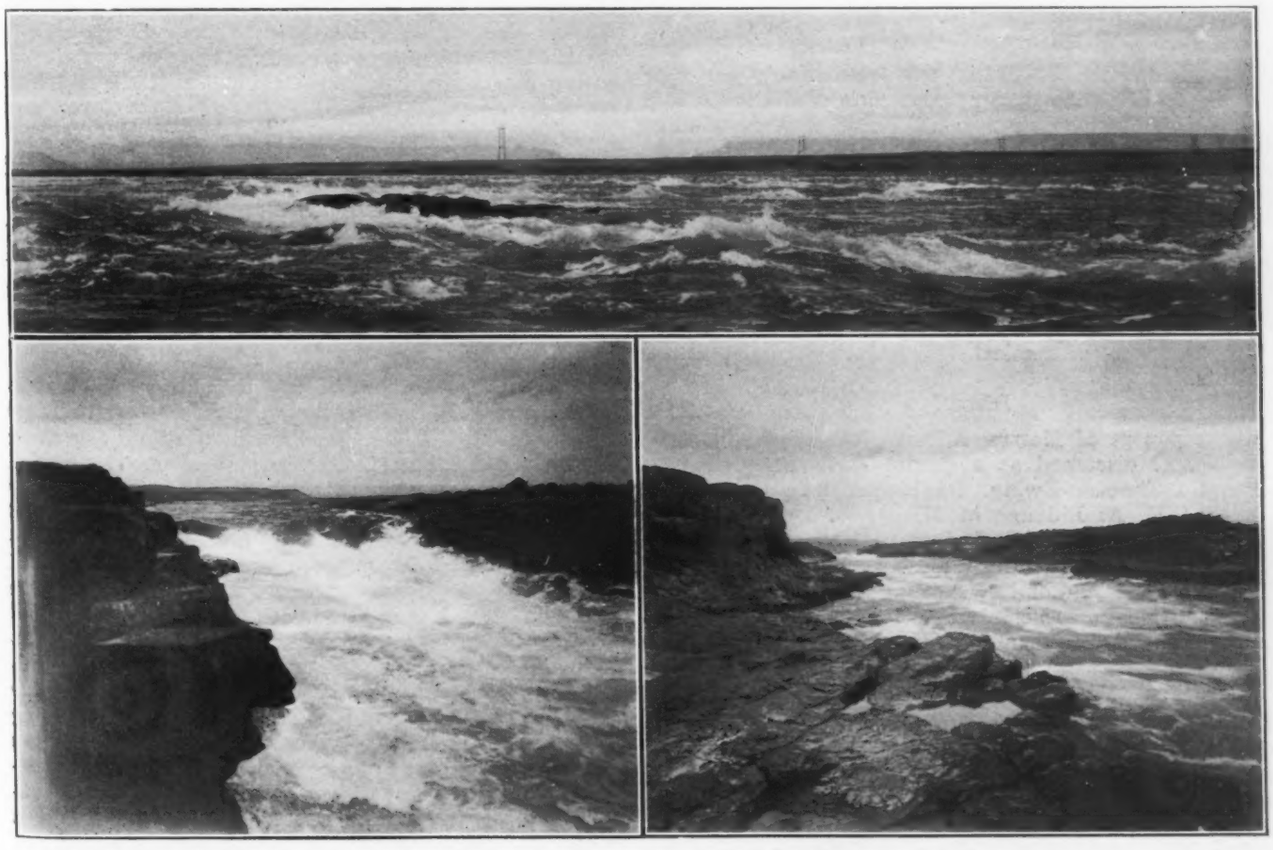
TWO closely related yet separate water-power conferences were held in Washington on Wednesday and Thursday of this week. One was given under the auspices of the committee on development of water power and the Washington (D. C.) Section of the American Institute of Electrical Engineers, and the other formed part of the general meeting of the American Electrochemical Society.

The institute meeting of Wednesday, which was very well attended and exceptionally interesting, dealt with the purely engineering and economic question of water-power development as related to national industrial efficiency and preparedness. The committee at whose suggestion the meeting was held saw a further opportunity for service to the nation by directing the attention of the public and of Congress to the fundamental engineering and economic principles that underlie the water-power question and which must be taken into account if hydroelectric development is to be encouraged and stimulated with a corresponding effect on the development of the great electrochemical and similar industries which are essential to the industrial independence of the nation. The papers presented sought to correlate several of those phases of hydroelectric developments which are of peculiar and perhaps unusual importance at the present time.

The subjects discussed embraced the values of water powers respectively to the electrochemical industries, to the food problem, to increased transportation, to national defense, and to finance. All were very ably handled. Dr. Lawrence Addicks speaking for the electrochemical industries, Dr. Allerton S. Cushman for the agriculturists, Dr. L. B. Stillwell for the transportation engineers, Dr. W. R. Whitney for national defense, and Gano Dunn for the investment bankers. So great was the interest in the discussion that the session did not adjourn until midnight.

The Electrochemical Society devoted its Thursday afternoon session to a symposium on Niagara Falls power and American industries, and listened to illustrated lectures on Reclamation Service water powers by A. P. Davis, chief of the U. S. Reclamation Service. On Thursday evening an address on the subject of water-power development for electrochemical purposes was presented by H. J. Pierce of Seattle, Wash.

The session dealing with the situation at Niagara was much more spirited and peppery than the Institute session of Wednesday and there was no mincing of words in expressing the attitude of electrochemists towards the government authorities in permitting conditions to drift at Niagara so that the industries there cannot get sufficient power for their needs. What this means not only to the electrochemical industry but to the vast number of other commercial enterprises depending on Niagara Falls products, was plainly and forcefully stated. Nor was the criticism destructive, for



WATERPOWER AGGREGATING 1,700,000 HP. IS RUNNING TO WASTE IN THE COLUMBIA RIVER THROUGH GOVERNMENT INACTION. ABOVE IS PICTURED A 40,000-HP. WATERPOWER SITE ON THIS RIVER IN THE STATE OF WASHINGTON

various methods of obtaining more power at Niagara Falls without in the least detracting from its present scenic grandeur were presented.

Energy Requirements for Electrochemical Purposes

In a paper entitled "Electrochemical Industries and Their Interest in the Development of Water Powers," Lawrence Addicks pointed out that these industries offer nearly ideal loads of considerable magnitude for central stations, but electrical energy must be obtainable at even less cost than Niagara Falls power before it will be in marked demand for electrochemical purposes. Furthermore, the available energy must be near the electrochemical market and source of supply for raw materials, but the nature of the industry determines whether cost of energy, transportation charges or labor is the factor ruling the location of the plant. In variance with oft-expressed opinions, however, electrochemical plants can seldom be operated on off-peak power, declared the speaker. These industries, so far, have not in general found it economical to develop their own power singly, but in time may co-operate to develop energy as a group. In view of the foregoing considerations a liberal water-power policy on the part of the government would be a step toward making inexpensive energy available for this extensive industry.

In connection with the production of nitrogen for the manufacture of fertilizers, A. S. Cushman, in a paper on "Water-Power Development and the Food Problem," showed the relationship of low cost of water-power energy to the cost of food plants.

Relation of Water Power to Transportation

Some of the conditions which determined the value of water power in relation to transportation, and how this value may change with progress in producing power from fuel and with changes in interest rates demanded for capital, were outlined in a paper by Lewis B. Stillwell, entitled "Relation of Water Power to Transportation."

Estimates were given on the approximate economic limits to investments in hydroelectric plants when coal can be obtained for steam plant operation in the vicinity at $1 to $5 and when the capital charges are 9, 12 and 15 per cent. It was pointed out that if water power has to be supplemented by steam reserve equipment the amount that can be economically invested in the hydroelectric plant is reduced by the cost of the steam plant. Attention was also called to the fact that the decreased cost of steam-power plants and increased fuel economies obtained in recent years have reduced very considerably the limits to economical investment in water-power plants.

Discussion

The papers of Messrs. Addicks, Cushman and Stillwell were discussed as a group by Commissioner of Patents Thomas Ewing, David Rushmore of Schenectady; F. A. Lidbury of Niagara Falls; Henry G. Stott of New York; J. J. Carty of New York; Gano Dunn of New York; Dr. Whitehead of Baltimore, and Dr. Leo Baekeland of New York. All were agreed that the question uppermost is how to get cheap power to permit the development of the electrochemical industries.

Mr. Stott told how, fifteen years ago, Niagara energy was cheaper than steam power, while to-day, owing to advances in the art, steam-generated energy, especially in stations operating on load factors around 60 per cent, is cheaper. Within fifteen years, he said, the capital cost of steam stations has been cut in two and the efficiency of the equipment has been improved to such an extent that it requires only half as much coal to generate the same amount of electricity and this in spite of the increasing cost of labor and fuel. He suggested that even such a large hydroelectric company as the Niagara Falls Power Company would find it cheaper to install a steam driven station and operate it in conjunction with its development at Niagara Falls. Then the bulk of the load could be carried by the hydroelectric equipment and the peaks by the steam driven equipment.

Dr. Baekeland told of the power famine confronting electrochemists and how the industry cannot expand or go forward without cheap and abundant power. He complained of the wasteful methods of financing in this country where a development is saddled with investment charges of 9 per cent before operations begin, while in Europe the money costs about 4 per cent. Fertilizers, he said, cannot be made where a plant has such fixed charges for capital because energy must be very cheap and no plant having to pay $9 on a $100 investment yearly can make energy cheaply enough for the fixation of nitrogen.

President Carty said the government is to blame for the high rates which prevail. If it would remove the uncertainties which again has cast about the tenure of the grant, bankers would be content to recommend the investment at lower costs. Give the investment stability and money would be cheaper. The thought was expressed that everything should be done to conserve the coal of the country, and this can best be done by developing the water-powers.

Water Power and National Defense

Failure to establish industries for the production of ammonia and nitrate compounds in the United States in the past, W. R. Whitney pointed out in a paper on "Water Power and Defense," has been due to economic conditions. Proximity of Chilean products and the impossibility of competing with the cheap water powers of Scandanavia as well as the lack of a near-by agricultural demand were named as important factors. At the present time, however, it seems essential to national safety that a nitrogen fixation industry be established whether it be self-supporting or not on the basis that thorough industrial organization is the best preparedness for either peace or war. The problems involved are many-sided and far-reaching, and hence the author of the paper believes that it is most desirable that the various government departments concerned, those of the Army, Navy, Agriculture and Interior, should cooperate in determining the course to be taken.

Why It Is Difficult to Attract Capital for Water-Power Development

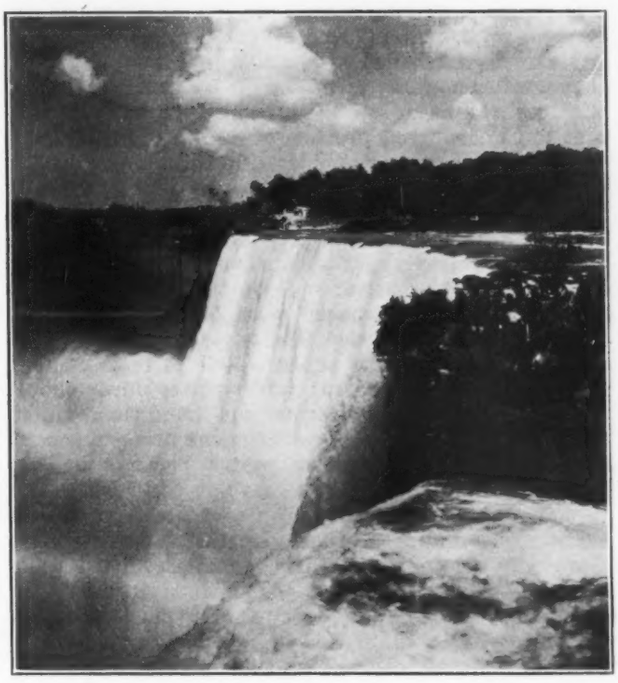
Certain aspects of investors' attitudes toward water-power developments were presented in a paper by Gano Dunn, entitled "The Water-Power Situation, Including Its Financial Aspects." It was pointed out that actual and threatened laws, popular prejudices and some cases of unprofitable developments in the past have retarded water-power developments. Physical and natural difficulties also handicap hydroelectric plants as compared with steam plants, making it essential that a reasonable profit be offered to induce investment of capital.

On account of the increasing cost of labor and materials, increasing taxation, and the fact that the efficiency of converting water power to electric power has practically reached a maximum, the cost of generating hydroelectric power is increasing and will continue to do so. On the other hand, steam-electric energy is decreasing in cost because continual improvements in converting heat energy into electrical energy have been made and may be expected.

The papers by Dr. Whitney and Mr. Dunn were read at the Wednesday night session before a large audience,

among whom were a number of representatives from Congress. The discussion was long and very interesting and was called to a halt at midnight. Joining in it were F. A. Lidbury of Niagara Falls; Lawrence Addicks of Arizona; John H. Finney of Washington; L. H. Baekeland of Yonkers; C. P. Atwater, Calvert Townely of New York; David Rushmore of Schenectady; Congressman G. R. Smith of Minnesota, and O. T. Crosby.

Mr. Lidbury said that continuous power is essential to the electrochemist, although there might be some processes which could use intermittent power. However,



FOUR MILLION HORSEPOWER RUNNING TO WASTE AT NIAGARA

By international treaty 80,000 hp. is still available on the American side and badly needed by the electrochemical industries, but the government will not sanction its use.

what the generating companies are asking electrochemical companies to do, he said, is to double their investments, and electrochemical investments per kilowatt of power employed is very much greater than water-power investment per kilowatt. Hence the unattractiveness of the offers of cheaper secondary power. President Addicks said if the energy cost less than $10 a kilowatt-year some of the arc processes might use it or the aluminum industry. Mr. Finney, however, speaking for the Aluminum Company of America, said it was at present engaged in erecting 150,000-hp. in hydroelectric plants and even after operating twenty-four hours daily for 365 days a year, cannot make enough metal. He also cited, as an obstacle, the very large investment necessary to take advantage of the low rate.

The most spirited discussion was that of Mr. Crosby, who spoke of regulation and the twilight zone between state and national supervision. He suggested that the state and nation co-operate in fixing the location of the physical property so that there need be no question of the right of the power plant to be where it was. The question of regulation of the enterprise should then be left entirely to the state authorities and the rate should be governed by contract between the utility and the vested authority. Then he said the conditions would be written in the bond, the investor would know exactly what he was buying and the public what it would have to pay for the service.

Symposium on Niagara Falls and American Electrochemical Industries

Available Power in Water Wasted at Niagara—Summarization of Industries Served—Evening Lecture by H. J. Pierce

At the meeting of the American Electrochemical Society held at Washington on Thursday afternoon, an interesting discussion on water-power development at Niagara Falls, electric furnace products, electrochemical processes and nitrogen fixation processes was presented. The symposium included four papers presented by I. R. Edmands, F. J. Tone, A. H. Hooker and W. S. Landis.

In the section taking up power development at Niagara, Mr. Edmands reviewed the conditions of a treaty between the United States and Great Britain, which went into effect in May, 1910, and determined the amount of water which may be used on each side of the river at Niagara Falls for power purposes. This treaty permits a total diversion from Niagara Falls of 56,000 cu. ft. of water per second from an average flow, or a diversion of 26 per cent of the average flow. The power companies on the United States side of the river have for years used all of the water this government will allow, which is 4400 cu. ft. per second less than the treaty provides. This amount of water is going to waste over the falls, and is capable of developing about 80,000 hp. The power companies have asked the government for a permit to use it and are ready and desirous to convert it into electrical energy, if the United States government will grant necessary permits. Mr. Edmands expressed the opinion that this waste of water should be saved if it can be done without destroying the scenic grandeur of Niagara or adversely affecting navigation, which now seems to be entirely possible.

There are two large power companies on the United States side of the Niagara Falls and three on the Canadian side. A small amount of water is allowed for power purposes on the Erie Canal in New York State, and also some is allowed for power purposes from the Welland Canal in Canada. Both of these uses divert water from Niagara Falls. The total amount of water now being used at Niagara and on the Erie Canal in the United States is 15,600 cu. ft. per second, from which about 215,000 hp. is developed, and this is all used in the United States. The total amount of water now being used at Niagara and on the Welland Canal in Canada is about 29,000 cu. ft. per second, from which about 360,000 hp. is developed, of which about 175,000 hp. is transmitted to the United States. The grants or permits under which power plants on the Canadian side were built, provided that half of the output of the power houses on the Canadian side should be reserved for Canadian demand when wanted. Nearly one-half of the combined output for the various power houses on the Canadian side is now being transmitted to the United States and, therefore, there is little prospect of further relief for the demand for power on this side of the river from Canada. The development of additional power in Canada is needed there, and this will undoubtedly be completed up to the full amount of water limited by treaty as soon as the actual work can be done. An additional 25 per cent of the average flow of the Niagara River, if properly converted into power, would equal about 1,000,000 hp.

Mr. Tone contributed a review of the development of industrial and metallurgical arts, and showed not only how such development is indebted to Niagara water-power, but how important it is to this nation in making itself industrially self-contained. He gave the estimated production of finished steel in the United States for 1915 as 28,000,000 tons, and stated that in a major

portion of this high-grade electrically-produced ferro-silicon is employed as the chief deoxidizing agent. Niagara Falls is the home of ferro-silicon in the United States, and up to the present time the total domestic production has been made from Niagara power. The commercial development of aluminum, he stated, was made possible by Niagara power, and that Niagara Falls was for many years the only seat of the industry.

There are five plants making electric-furnace abrasives, carborundum and alundum, from Niagara power, three of which are on the American and two on the Canadian side of the river. Calcium carbide is another electric-furnace product from which is produced calcium cyanamid, the most important compound to-day in the field of fixation of atmospheric nitrogen. The production of artificial graphite is an electric-furnace industry that owes its inception and entire development to Niagara power. All of the manufactured graphite used in the world is produced at Niagara Falls.

THE CHEMICAL INDUSTRIES

In a summarization of chemical industries developed at Niagara, Mr. Hooker referred to chlorine as originally an annoying by-product now considered a necessity and produced in this country entirely by electrolytic processes, with Niagara Falls as the center of the industry. Other electrochemical products referred to were caustic soda and caustic potash, metallic sodium and phosphorus. The important manufactures and products dependent upon the electrochemical industry at Niagara Falls were given as paper mills, soap factories, gold mines, the manufacture of chloroform, disinfectants, matches, explosives and dyes, water purification, cotton finishing and oil purification.

THE NITROGEN INDUSTRY

Mr. Landis reviewed the commercial fixation of atmospheric nitrogen along three independent lines, the cyanamid, arc and synthetic ammonia processes. The work started in 1895 became a factor at Niagara Falls, Canada, in 1910, when steady production began. The third process reached the commercial stage in 1913 under developments by Badische Company in Germany, with attempts to introduce it in this country in 1914.

Nitrogen fixation processes all require electric power for their operation. The arc process produces nitric acid directly, and uses nearly 3 hp.-years of electrical energy per ton of HNO_3 produced. The Haber (synthetic ammonia) process, whose sole product is ammonia, uses considerable quantities of energy, though little is heard of this phase of the process. The author stated that considering the end product of the cyanamid process as nitric acid, the power consumption required for fixing the unit of nitrogen by this process is only one-fifth to one-sixth that of the arc process.

None of the three main nitrogen fixation processes have found a place within the borders of the United States. On account of the excessive power requirements of the arc processes, the author is of the opinion that no serious thought has existed as to its adaptability to conditions in the United States, for cheap water-power in sufficient quantity is not available in such districts as would enable the nitric acid made to compete with present sources, and as an emergency measure for munitions manufacture there is not sufficient power available to operate a plant of the necessary size. It has been estimated by the military boards that in the event of war this country would need 180,000 tons of concentrated nitric acid per year. The arc processes in their present state of development could furnish this requirement with the expenditure of approximately 540,000 hp., which is 20 per cent more than is developed on both sides of the boundary line at Niagara Falls. The cyanamid process could meet this emergency requirement with only 100,000 hp.

Active attempts were made several years ago to bring the cyanamid industry into the Southern States, but the policy of the government with respect to water-power absolutely prevented development at that time. Since then the serious handicap of the higher power costs in the United States has discouraged efforts here.

LEGISLATION ON BUSINESS PRINCIPLES NEEDED

The lecture by H. J. Pierce on Thursday was well illustrated by striking motion pictures of American and foreign water-powers and electrochemical industries. Mr. Pierce marshalled a quantity of interesting facts about water-powers harnessed as a great industrial producer, the nature of these being such as to be relevant to the dominant problem of military preparedness.

Speaking of legislation, Mr. Pierce said: "The belief that any law that Congress may enact would be eagerly accepted by would-be power-developers and the investors upon whom they are dependent for the means of developing, is a delusion, and the sooner it is abandoned the better will be the opportunity for obtaining legislation based upon business principles and business experience. The investor must know in advance the conditions under which he is to conduct his business, and federal water-power laws should specifically define the terms and conditions under which permits for use of government property necessary to the development of water powers shall be issued. This is just as necessary to the guidance of ever-changing heads of government bureaus in conducting the affairs of their departments as it is to those who would invest their money development of our water powers. To be of effect, federal legislation governing water-power development must be of a nature to protect the public interest, be fair and business-like toward capital, and place not a featherweight more burden on the operation of water powers subject to the control of the federal government than is borne by completing hydroelectric developments not subject to federal control. There is no reason why these things should not be so co-ordinated upon a solid business basis as to protect every interest and bring results.

"Thus, it is apparent that there is vital and imperatively urgent necessity for the enactment of practical federal water-power legislation of a character which will promote and encourage in every way the development and utilization of the enormous quantity of energy latent in our streams and now wasting to the sea, a necessity in no way local, but national. It is necessary for the manufacture of ammunition for the national defense; necessary for the manufacture of fertilizers that the cost of living may be decreased through increase in crops; for the electrification of railroads for the cheap carrying of freight, and to provide a means of rapid and comfortable transportation for the people; necessary to the irrigation of vast tracts of lands, meaning the building of thousands of homes on lands now silent; necessary to the establishment of great and entirely new industries in the United States, meaning the investment of hundreds of millions of dollars, the building of new cities and towns and the employment of thousands of men and women; necessary if we are to maintain our commercial standing among the manufacturing nations of the earth; necessary in order that coal and oil may be preserved for the use of future generations, and, finally, of vital necessity toward promoting the safety, the comfort, the welfare and the prosperity of every citizen of the United States."

Educational Work of New York Edison Company

Lecture and Laboratory Classes to Develop the Larger Usefulness of Technical, Accounting and Commercial Employees, Conducted by the Company and by the Employees Themselves

THE larger central-station companies are giving their employees an increasing number of educational opportunities and advantages. Until very recently this work was limited to a very few companies, but within the last year others have been started and now additional corporations are considering classes which will help employees to be more familiar with the principles underlying their work. The substantial benefits which are apparent make it clear that the fostering of education in central-station companies will continue. While the expense, the larger forces of employees and the greater educational advantages in the main cities confine such benefits chiefly to the more important properties, some of the companies of medium size are much interested in the established schools and are talking of following the example on a reduced scale.

The schools are inspired by the purpose of improving employees and thus attaining higher efficiency in service. But certain differences in the precise objects sought are brought out by a contrast between the practices in Chicago and New York. Articles in the ELECTRICAL WORLD of Oct. 30, 1915, and Nov. 20, 1915, described the particular aim of the Chicago Central Station Institute, the subsidiary institution which conducts the educational work of the Commonwealth Edison Company and other near-by properties controlled by Samuel Insull and his associates. Three of the Chicago classes are open only to employees of the supporting companies, but one feature of the work—the class for the training of college graduates—stands out above all others. The Chicago institute assists these young men to fit themselves to take up eventually the duties of minor executives. As the companies can absorb into their organizations only a limited number of such specially trained men each year, the institute exists primarily for about forty "student-employees" at a time, although, as stated, general classes are conducted for a number of other employees.

In New York, on the other hand, the educational work in which the Edison Company is the pioneer among central-station companies, is designed fundamentally for the masses of employees. Its extent is indicated by the statement that the total enrollment for all of the varied courses in the different departments is approximately 1000.

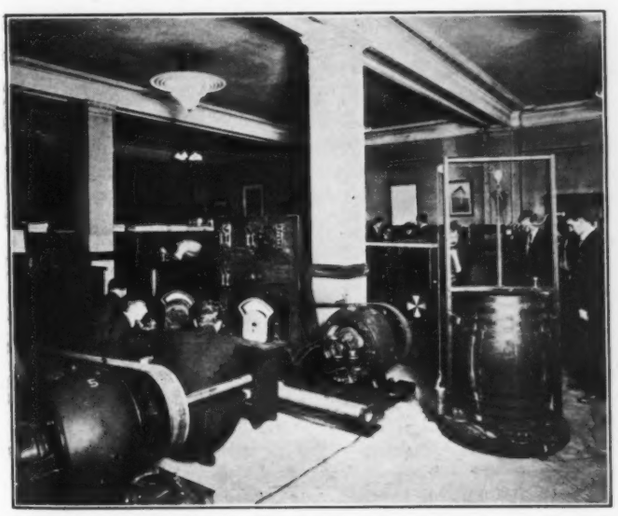
In New York, as in other cities, no one thinks of the educational work as philanthropic. It is a series of plain business transactions in which the results obtained are worth the outlay required. The cost is not a small item, and the advantages gained by the company and the public must be equal to it. This is the position which the executives of the New York Edison Company take in speaking of the very active classes which have been developed. They are glad to provide them, but they

Training, and the Employees' Commercial Courses of the New York Edison Company

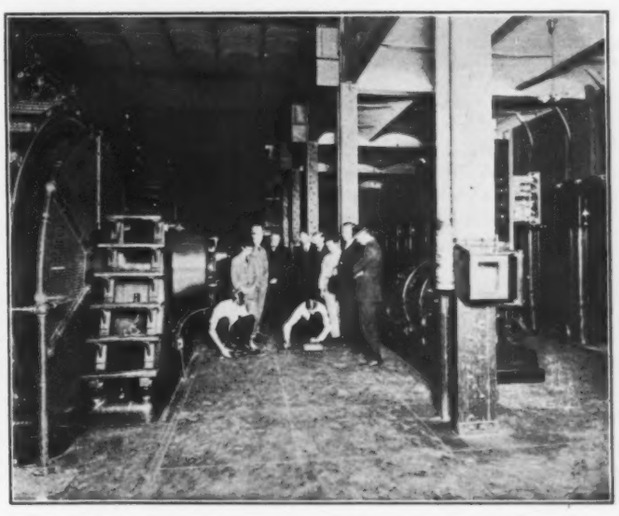
A STATEMENT BY ARTHUR WILLIAMS

If those who have written the history of civilization from its beginning down to the present are correct in their conclusions the greatest forces vital to the progress of the human race are the moral and the intellectual. To be willing to perform our duty is the moral part; to know how to perform it is the intellectual part; while the closer these two parts are knit together the greater the harmony with which they work and the more securely shall we lay the foundation for the further advancement of mankind.

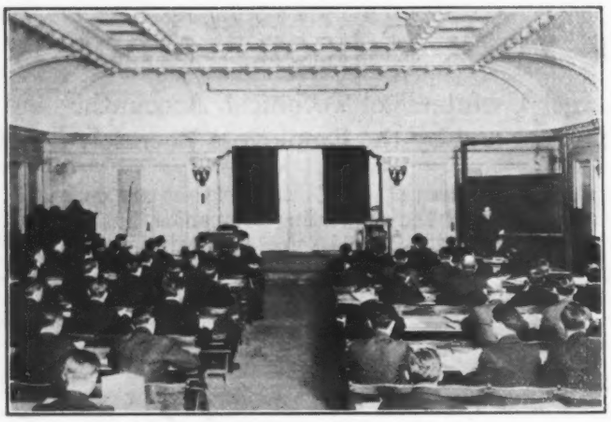
The intellectual part can be developed only through education. The training must be broad in character and so carried on as to develop the individual mind and inspire the individual to strive for a standard of accomplishment as high as the individual can conceive. Other things being equal, the trained mind always excels the untrained mind. Thus a well-planned system for training the employees of an industrial corporation must have two results—the first, individual development to the benefit of the individual, and the second the result of this development to the corporation. The public will then profit by a more complete service. On these principles the commercial courses of the New York Edison Company are founded.



EMPLOYEES ENROLLED IN THE NEW YORK EDISON COMPANY'S TECHNICAL SCHOOL AT WORK IN THE SCHOOL LABORATORY



TEST ON A ROTARY CONVERTER IN SUBSTATION DURING INSPECTION TRIP BY MEMBERS OF EMPLOYEES' TECHNICAL SCHOOL



Fitting the Accountant for His Larger Responsibilities—The Work of the Accounting School of the New York Edison Company

BY H. M. EDWARDS

Auditor New York Edison Company

There is always, in a large corporation, a sufficient amount of routine work to occupy the entire time of many men. Men so engaged have usually entered the company's employ directly from school and, more often than not, before reaching the higher school grades. They are, therefore, imperfectly equipped, and while they undoubtedly discharge acceptably the routine duties confided to them, their outlook is necessarily limited and it is my observation that they rarely comprehend the place they occupy in relation to the work as a whole. They have but an indefinite conception of what happened before the work reached them, and little knowledge and slight interest in what happens after it leaves them. This condition is due mainly to lack of education and mind training and not to inaptitude or indifference.

A knowledge of the principles on which modern scientific accounting is founded will correct this unfortunate condition. These principles are definite and do not vary in their application because of the character or the mass of the detail work carried on. An employee who has mastered such principles will at once recognize the niche in the structure he occupies, and the mental effort to acquire this knowledge and the confidence in his powers begot thereby will surely act as a spur to his ambition to achieve a higher place in his organization.

The advent of governmental regulation of public utility companies, and the great part which accounting departments records play in such regulation, has very greatly increased the responsibilities resting upon the employees in such departments. It is of the utmost importance that the affairs of the companies, as reflected in their accounts, shall be properly presented to the authorities, and this requires that the accounting official shall have a good working knowledge of the work carried on in all the departments of the company, and also be possessed of the ability to co-ordinate all this work and see that it is accredited its proper place in his records and in his reports. No one man alone can effect such results. He must have full co-operation of able assistants familiar with the immense amount of detail if his work is to measure up to the severe requirements demanded.

The accounting school of the New York Edison Company was founded because of these conditions, and the results achieved in the school have more than realized our anticipations.

can justify themselves to the public and the stockholders only when the outcome is an unquestioned betterment in service.

Welfare from the Community Viewpoint

This strictly business argument, of course, presents only one side of the welfare question involved. From the community viewpoint there is a broader issue than this one of whether the company has its fair compensation in more able employees. Many of the employees who are given the opportunity to study in this way started in the world illy equipped by educational advantages to make much progress in business. They are given more instruction, they are encouraged to study and read wholesome literature, and it is not cant to say that they thus become finer citizens. Interesting as that consideration is, the officials of the company did not mention it in their talks with the representative of the Electrical World. They restrict themselves to the statement that the more thoroughly the employees appreciate and understand the meaning of their work, the better prepared they will be to co-operate in the intangible influences on which good public service so largely depends.

Looking at the educational work in New York as a co-ordinated plan of the company distinct differences in applying the general policy are adopted in the different departmental courses. For instance, neither the technical nor the accounting courses are compulsory with the employees in the departments concerned. The courses in these two departments are given, not on company time, but on the time of the employees. They are under the immediate direction of a committee of the Employees' Association. The general commercial studies, however, are compulsory for every employee of the contract and inspection departments, who must obtain in the course of his connection with the company a formal certificate that he has been graduated from the school. Under these circumstances the classes are conducted mostly during the regular office hours.

Classwork Required from Commercial Recruits

The reason which is given for the fact that the educational work is required from the commercial employees, and is wholly optional in the other departments, is logical from a business standpoint. It is that the commercial department representatives are subject continually to public inspection and judgment. Very often the opinion which is formed of them is the opinion which is formed of the company. If their demeanor in the pursuit of their duties does not please the people whom they see, an unfavorable opinion of the company is created which it may take years to eradicate. For this serious reason the commercial studies extend into such subjects as effective speaking and writing, salesmanship, psychology and even topics relating to health. The intent is that in their constant contact with the public the employees shall combine salesmanship and business with a heaping measure of courtesy.

One unusual result of the movement in New York is the attitude which other educational influences have developed toward it. The Board of Education of New York was ready to give some of the commercial courses by formally embracing them in its evening schools. But before a decision could be reached as to whether they belonged in the elemental or the high school divisions, it was necessary to proceed with the work, so that the company has continued to conduct the courses itself. The New York University School of Commerce, Finance and Accounts allows credits for the work done in the accounting courses.

In this connection it should also be said that it has been the consistent policy of the Employees' Association

to avoid overlapping with any of the many excellent courses of free technical instruction available in New York City, as it has been felt that employees desiring to obtain an extensive technical education could do much better by attendance at these institutions than by any educational work which could possibly be prepared by a private company. It is gratifying to note that a very large number of the students attending these technical courses have gone from them to the regular technical schools, and there is little doubt that in most cases the incentive to undertake the more extensive regular studies was furnished by the work conducted within the company.

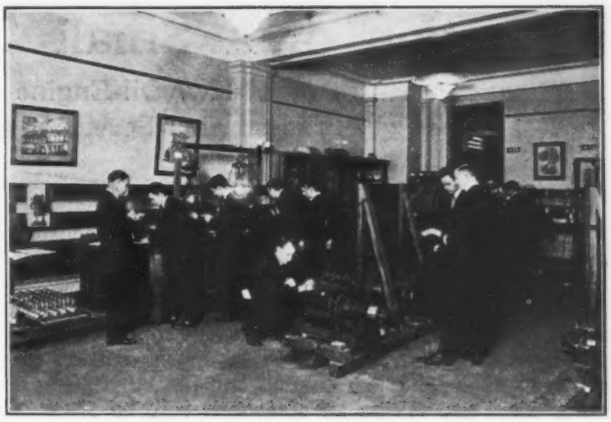
BENEFITS TO ASSOCIATED COMPANIES.

In New York, as in Chicago, the employees of associated companies benefit from the educational work. In addition to the New York Edison Company, therefore, the classes include pupils from the United Electric Light & Power Company, Consolidated Gas Company, New York & Queens Light & Power Company, Westchester Lighting Company, Northern Westchester Lighting Company, Peekskill Light & Railroad Company and Yonkers Electric Light & Power Company. The New York Edison Company, however, furnishes the majority of those who are in the classes and retains the direction of them in all respects. The centralization increases the availability of employees for transfer from one company to another when that is desirable and is an incidental advantage worth while.

The experiences of the New York Edison Company during the four to six years in which classes have been maintained are ample proof of the value of what they are doing. Employees who lacked theoretical knowledge have been carried far beyond the meager equipment of an indifferent common school education with which they began. College graduates who were entering the service have acquired familiarity with the property and with the practical problems of the business. Examinations, regular systems of markings and diplomas to successful graduates have assured attention in classes and zeal in outside study. Personal ambition has been aroused in men who did not want to fall into ruts, but had been steadily drifting in that direction. The accumulation of inspiring books in the library, as a result of the demand for information, shows progress. Moreover, definite signs of improved efficiency in daily work and habits are observable by the heads of departments while the percentage of employees who are dismissed is small.

Doherty Company Institutes Two New Schools for "Cadet Engineers"

Drawn up largely along the lines of its well-known training school for engineering graduates, which has been in successful operation at Denver, Col., for a number of years, Henry L. Doherty & Company have now opened two similar schools in connection with their utility properties at Toledo, Ohio, and Bartlesville, Okla. The courses average eighteen months to two years, and during the period of training the cadet gains experience in plant operation, engineering-office work, accounting, and the sale of electric service and equipment. In these training schools the "cadet engineers" are given classroom instruction in the practical reasons underlying the work which they perform for the local companies during the day. Besides the monthly salaries earned by the men, each cadet receives 50 cents a night for attending classes but is fined $2 for every such class missed. F. R. Coates is in charge of the newly instituted Toledo school, and A. J. Diescher heads the Bartlesville school.



Laboratory Instruction in the Technical School Conducted by the Employees' Association of the New York Edison Company

BY ALEXANDER MAXWELL

Chairman Educational Committee, Association of Employees

The technical school for employees of the New York Edison Company is notable among similar enterprises of the same magnitude, because it has been planned and conducted by the employees themselves through a special committee of their Employees' Association. Not only is attendance voluntary, but the plan and scope of the work has been developed by the employees to meet their own special requirements. With this important fact in mind it may be interesting to review the development of the enterprise.

Technical instruction was first provided in 1906 in the form of evening lecture courses on electrical subjects. These lectures were illustrated by platform experiments. It was soon noticed that experiments conducted in this manner were by far the most effective part of the work, surpassing in interest the spoken part of the lecture. This suggested the desirability of preparing courses of instruction based almost entirely upon laboratory work, and accordingly such laboratory courses were started in 1910. At the beginning these courses were divided into three grades, consisting of elementary, intermediate, and more or less advanced courses in electricity. Changes were made in the grading of the courses from time to time, as experience indicated the necessity for this, until at the present time the school conducts five graded courses, each consisting of about twenty two-hour laboratory periods and eight hours of classroom work. The ground covered in the courses ranges from experiments in elementary mechanics and physics to experiments in simple alternating-current problems.

All of the laboratory problems, particularly in the more advanced courses, are arranged with special reference to the technical features of the New York Edison Company's system, in order that the school work may be of the greatest practical benefit to the students in connection with their work in the company.

The expense for the conduct of this enterprise is borne entirely by the company, as it is beyond the resources of the Employees' Association. The fact that the officials of the company have found it desirable to support this school so generously is good testimony not only to the intrinsic value of the enterprise, but also to the soundness of the general relations which exist between the company and its employees.

Operation of a Small Town Generating Station

Automatic Features of 34-Kw. Oil-Engine Storage-Battery Plant That Furnishes Twenty-Four Hour Service to a Community of 431 People

WHEN designing the generating station at Thompson, Iowa, to furnish its 431 inhabitants with twenty-four hour service, special considerations were given to arrangements that would reduce operating details in the handling of the plant load. As now operated, one man acts as plant engineer, meter reader, new-business solicitor, wireman and repair man for the entire system. His duties in the station consist only of keeping the fuel oil and the lubricating oil tanks filled and taking an occasional reading from the switchboard instruments.

The station equipment consists of two Bates & Edmonds Motor Company's double-cylinder 28-hp. oil engines directly connected to two 17-kw., 220/110-volt, three-wire, direct-current Triumph generators operated in conjunction with a storage battery of 116 "E. S." cells made by the Electric Storage Battery Company. A combined balancer and booster set made by the Triumph Electric Company is also installed, and the equipment controlled by an automatic system designed and constructed by the Strong Electric Company of Des Moines, Iowa. This apparatus is arranged so that the very light loads on the plant are carried by the storage battery. When the load increases beyond a predetermined value one of the two 17-kw. units is started. Should the load increase beyond the rating of the one engine the second unit is automatically started. The battery is charged automatically while the engines are operating. Whenever the load decreases beyond the predetermined limits the engines automatically stop and the battery takes the load.

All current passing to or from the storage battery must also pass through a special ampere-hour meter connected in series with the battery. The needle or hand of this meter is provided with a platinum point which engages other platinum points at different positions around the dial of the meter. When current is being discharged from the battery the meter hand travels in the discharge direction until it makes contact with a platinum point located on the 50 per cent discharge division of the meter scale. When this contact is closed the switching mechanism is operated so that one engine and generator is started with the generator acting as a motor. As the battery is charged the hand on the meter travels back toward the full-charge position, and when it reaches the full-charge point makes another contact, stopping the engine and generator.

A mercury-type reverse-current time relay is placed in series with the generator. Whenever the engine and the generator are started the current which is being used to operate the generator as a motor will cause the hand on this reverse current relay to travel slowly over its scale and close a contact after a certain interval of time has elapsed. When this contact is closed the switches which control the generator are opened. In this manner the machine is prevented from taking excessive current from the battery in attempting to start the engine. The time limit of this reverse-current relay is set so that ample time is provided for the engine to start firing. If it does begin firing the action of the generator causes the hand on the reverse-current relay to return to its original position so that it will be in readiness to start the engine. Should the hand on the ampere-hour meter come to the half-discharge position for starting the engine and generator, and the engine fail to fire, the hand on the ampere-hour meter then travels in the discharge direction. At the 70-per cent

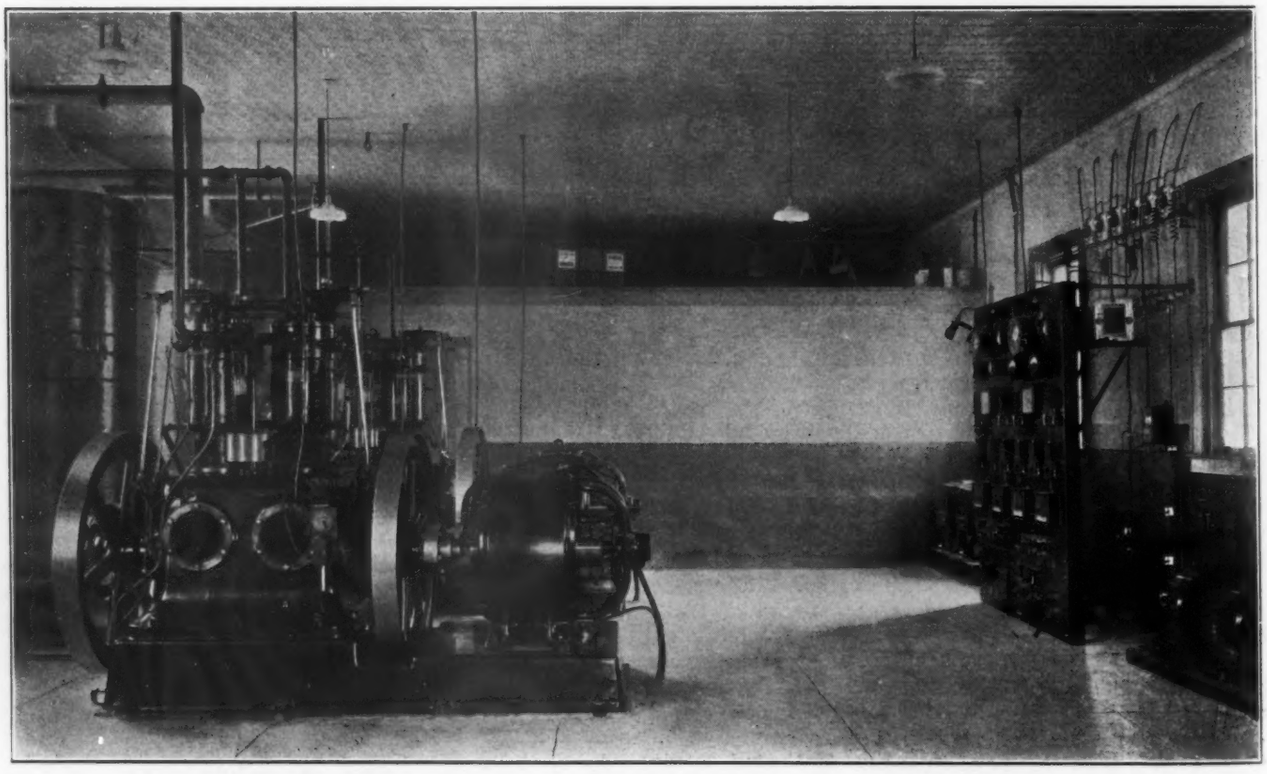


FIG. 1—TWO 17 KW. OIL ENGINE DRIVEN DIRECT CURRENT GENERATORS IN THOMPSON (IOWA) STATION

discharge point it would make contact again, operating the shunt trip breaker to cut off the battery. This action prevents overdischarging of the battery.

The reverse-current relay is so arranged that when the engine is cut off by its action a signal circuit operates bells or other warning devices.

The generator, when it is operating, runs as a compound machine, supplying current directly to the line and also to the battery through the battery booster. The battery booster is provided with a shunt field winding and as well with series field windings. When the generator is running a relay closes the circuit to the shunt winding on the booster, causing the battery to be charged. When the engine stops the circuit to the shunt field winding is opened and the battery discharges through the booster armature to the line. At times when the battery is called upon to supply current to the line and also to start the engine, a special series field winding is brought into action to cause the booster to raise the battery voltage sufficiently to compensate for the resistance drop. The circuit to the shunt field is always held open until the engine starts firing and driving the generator. Current passing to the line also flows through the series fields on booster, so that when the engine and generator are running the action of the line current in the series field is to buck that of the

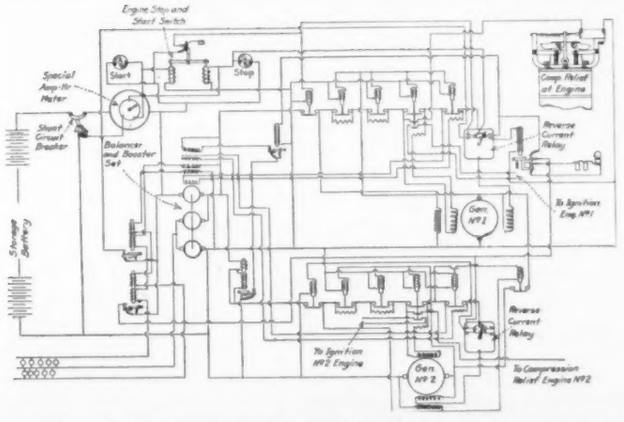


FIG. 2—STATION WIRING DIAGRAM SHOWING METHOD OF CONTROLLING ENGINE OPERATION

shunt field winding and to reduce the charging rate of the battery. Whenever the engine and generator are not operating and the battery is supplying current to the line, these series field windings compensate for the resistance drop of the battery, maintaining practically a constant line voltage between full charge and half discharge of the battery.

The engines of the equipment are provided with an automatic compression relief so that at starting no extraordinary load will be thrown on the battery. The compression relief valve is operated by a solenoid, which is energized during the starting operation by action of the switching mechanism. When the engine attains practically full speed the relief valve is closed. The flow of current to the generator when it is cranking the engine is controlled by a series of solenoid switches, which in turn short-circuit consecutive portions of the starting resistance, as the engine is brought up to speed. As a further protection the starting equipment at Thompson is arranged so that if engine No. 1, which is started first as a load comes on, fails to fire, it is cut out and unit No. 2 is started. The failure of unit No. 1 to start operates the alarm circuit to indicate that the services of the engineer are required.

Since this automatic plant was installed at Thompson the operation of a gasoline engine on the city water-pumping system has been discontinued. A 5-hp.

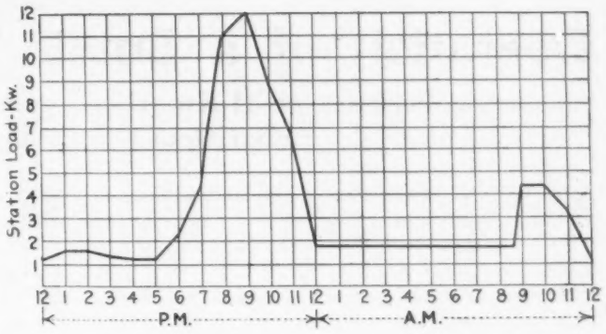


FIG. 3—AVERAGE LOAD ON THOMPSON (IOWA) STATION

Triumph motor driving a Luitweiler pump now does this work. Other motors on the system are located in the schoolhouse and in the town's two garages. The school has been found to be one of the plant's best customers, for in addition to the 4-hp. 220-volt motor on its heating system, it operates many electrical appliances in its domestic science department.

The total cost of the electric lighting system at Thompson, including the power station and its equipment, pole lines and meters, slightly exceeded $13,000.

INCOME AND OPERATING COSTS

For the month ending April 10, 1916, the plant output was 1545 kw.-hr. and the gross income was $207.21. The lighting rates for energy are 15 cents for the first 20 kw.-hr., 13 cents for the next 20 kw.-hr., and 11 cents for all over 40 kw.-hr. The power rate is 10 cents per kilowatt-hour. A minimum charge of $1 per month is made. The operating expenses for the month ending April 10 were as follows:

Fuel oil—760 gal. at 8.5 cents	$64.60
Lubricating oil	7.50
Operator's salary	65.00
Total	$136.10

A lower fuel cost than 4.18 cents per kilowatt-hour according to the above figures has been shown on short runs. During the month of March experiments with fuel mixtures were conducted which accounts for this high fuel consumption as compared with the operating costs for the month ending March 10, which showed fuel cost to be 2.7 cents per kilowatt-hour. The average load for the station thus far is shown by Fig. 3.

The business establishments in Thompson close at 6 p. m. except on Wednesday and Saturday nights. The street lights are turned off at 11 p. m. and not used at all on moonlight nights. According to C. C. Clifton, manager of the generating station at Thompson, service has been furnished continuously since the plant was started on Dec. 18, 1915, and its operation has proved entirely satisfactory.

FIG. 4—THOMPSON (IOWA) GENERATING STATION SHOWING OUTGOING LINES

Influence of the War Upon Electric Wiring Practice in Germany

Notes on the Use of Zinc Conductors and General Regulations Covering the Installation of Electricity in Dwelling Houses During the Period of Hostilities

THE necessity for substituting other available material for copper is receiving much attention in electrical circles in Germany as a result of the war, and the discussion of this subject has occupied considerable space in late issues of the journal of the Society of Electrical Works (*Mitteilungen der Vereinigung der Elektrizitätswerke*). The difficulties both of a mechanical and an electrical nature associated with the employment of iron conductors in insulated wires and cables suggested the importance of finding a non-magnetic material of greater conductivity and increased flexibility. Of the available metals zinc was the most promising electrically. Although in sheet form it is a common building material, zinc wire has scarcely ever been producd in large quantities, and there existed from the very start a fear that in view of the great brittleness of the crystalline zinc the production of wire would meet with difficulties. These were soon overcome sufficiently to enable wires to be produced from this material which, as regards mechanical quality, are only slightly inferior to copper wire. This has induced the Society of German Electrical Engineers to standardize alongside of jacketed wires, which were frequently found to be too stiff, the so-called KGZ wires (zinc conductor with rubber insulation), which above all were to meet the lack of a material which could be drawn into conduit.

The use of zinc conductors was also permitted for jacketed wires (class MPZ), and was even recommended in the case of lead-covered cables. The great advantage of zinc as compared with iron consists above all in the carrying capacity of the former, which is more than double that of the latter; moreover, the zinc is non-magnetic, essentially more flexible, and eliminates the problem of rust. In view of the novelty of the use of zinc wire and because of the lack of experience in its treatment wrong impressions were frequently formed among consumers as to the qualities of such material, especially as the zinc-wire products first marketed were found deficient in certain cases.

It was first thought possible to elaborate zinc wire from the unworked pig zinc, but special treatment was soon found to be necessary in order to secure wire of sufficient tensile and bending strength. These manufacturing difficulties have now been overcome. Zinc wires are being produced and laid in large quantities, so that the wire and cable commissions consider it suitable to tabulate the special qualities of zinc, the way in which it differs from copper and its advantages over iron in the manner shown in Table II.

It is also noteworthy that the actual resistance of iron wire to alternating current is essentially greater than would be calculated from the conductivity.

The mechanical qualities of zinc wire depend upon the crystalline structure of the metal. The coarser the latter, the more brittle and less resisting to bending and contortion will be the wire, while an increase in the fineness of the structure will cause the metal to be more refined. If zinc wire is exposed for a fairly long time to temperatures exceeding 100 deg. C., under certain circumstances changes in the structure can take place and the mechanical qualities of the wire can become deteriorated. Hence it is necessary to be cautious when heating zinc for any length of time to a higher temperature. So far nothing has been observed which would prove that changes in structure have a disadvantageous influence upon the electrical qualities of the zinc. Even if the solidity and bending strength are reduced, the electrical conductivity is not diminished. Local defects in the way of hollow and brittle places cannot wholly be avoided. It is well to keep in mind that corrosion may result in the use of zinc under unfavorable conditions.

Overhead Lines—Busbars and Switching Devices

German engineers hold that zinc wires or cables are not suitable for overhead lines, since mechanically weak places already existing or which might be formed under atmospheric influence might bring about breakage in view of the constant strain in overhead circuits. As a substitute for copper, only iron can be considered here for the time being.

Busbars, connecting lines and switching devices with bare conductors of zinc require little consideration except that bending in busbars should be effected with moderate warming of the bar to at most 100 deg. C., and in case of a small radius a special segment is desirable. The connection of the various lengths can be effected by iron screws. Where moisture or fumes are liable to occur varnishing with oil paint, paying special attention to points of connection, is essential.

The commission on installation and service regulations has decided, in agreement with the wire and cable commission, in view of the shortage of insulated wire of 1-sq. mm. section, to allow the use of insulated strand wire of 0.75-mm. section for stationary installations during the war, provided that the thickness of the insulation wall is at least 0.6 mm. and that the insulation consists of standard rubber.

Replacement of Copper in Electrical Machinery

The machine-standardizing commission has taken up the question in what apparatus and to what extent copper can be replaced by zinc or iron. G. Dettmar, secretary-general of the society, has prepared preliminary notes upon this subject. He states that in many electrical machines the windings can be made entirely or partly of zinc wire and the commutators and collector rings of iron without fear of difficulties arising from this cause. Inasmuch as little operating experience is as yet available, such apparatus cannot receive guarantees of safe running applying to equipment of standard construction. Machines with zinc-wire windings should therefore be debarred from installations where failure in service must be absolutely excluded, as in plants used in military operations. Machines of special design are also not suitable for the application of substituting metals, including equipment exposed to particularly low or high temperatures, as in open-air service. Careful provision for oversight in operation must be made in designing machines with iron commutators. The capacity of apparatus is reduced by the zinc winding, so that for machines with such construction higher prices will as a rule have to be charged for a given capacity than for the standard construction.

In Table III data compiled by the wire and cable commission covering the loading of zinc cables are given. When laying cables in the open air, or when installing them in conduits or other unfavorable circumstances, it is recommended that the highest load be reduced to three-fourths of the values indicated in the table. Installation in places subjected to severe concussion must be avoided. The table is based on an

TABLE I—LIMITS OF CAPACITY FOR APPARATUS WITH ZINC WINDINGS

THREE-PHASE TRANSFORMERS

Tension in Volts	Rating in Kva.	Tension in Volts	Rating in Kva.
Up to 130	0.10 to 250	3,000 to 5,000	3.50 to 250
130 to 260	0.15 to 250	5,000 to 10,000	7.50 to 250
260 to 550	0.35 to 250	10,000 to 15,000	10.00 to 250
550 to 1,000	0.75 to 250	15,000 to 20,000	15.00 to 250
1,000 to 3,000	2.00 to 250	20,000 to 30,000	30.00 to 250

From the above figures the German engineer decides for each case whether each wire—whether for primary or secondary winding or both—should be made of zinc. Single-phase transformers can be produced with zinc-wire windings for two-thirds the above rating limits.

THREE-PHASE GENERATORS AND SYNCHRONOUS MOTORS, WITH ROTATING FIELD WINDINGS OF ZINC WIRE

Speeds from 375 to 1000 r.p.m.

Output up to 150 kva. for three-phase current and to 100 kva. for single-phase current.

Direct-connected exciters must, on the whole, be given copper windings, as otherwise their output is not sufficient.

INDUCTION MOTORS FOR FIFTY CYCLES, WITH STATOR AND ROTOR WINDINGS OF ZINC

Speeds from 375 r.p.m. to 1500 r.p.m. Potentials up to 5000 volts.

For outputs of 3.7 kw. to 100 kw.

For outputs above 50 kw. it may at times be necessary to use copper windings in the rotor.

DIRECT-CURRENT MACHINES, ABOVE 100 VOLTS, ARMATURE WINDINGS OF COPPER, COMMUTATORS OF IRON, FIELD WINDINGS OF ZINC

Tension in Volts	Kw. Rating (Calculated for 1000 R.p.m.)
100 to 260	2 to 250
260 to 550	6 to 400

For other speeds the output changes in proportion to the number of revolutions. The maximum speeds are: Up to 50 kw., 2000 r.p.m.; above 50 kw. to 100 kw., 1500 r.p.m.; above 100 kw., 1000 r.p.m.

In some cases, particularly in heavy-current work or at high speeds, the commutator must be of copper for the above output.

ROTARY CONVERTERS FOR FIFTY CYCLES, WITH FIELD WINDINGS OF ZINC, OTHERWISE COPPER (ALSO FOR DAMPING WINDING)

Tension 100 to 550 volts.

Outputs of 10 kw. to 250 kw.

excess temperature of 25 deg. C., with permanent load and a laying depth of about 70 cm. The table applies so long as no more than two cables are laid side by side in the same ditch. Central conductors which are laid separately are not taken into consideration in this connection.

As regards prices, representatives of the cable factories stated in a recent conference that the elaboration of zinc from the raw pig zinc to the wire represents an expense of 125 marks to 150 marks per 100 kg., while the same cost for copper amounts to 15 marks. If one takes into consideration the increased prices of raw materials required for cable manufacture and assumes that the refined zinc costs about 70 marks per 100 kg., then the cable with the zinc conductors costs from 100 to 150 per cent more than copper cable of the same section used to cost prior to the war, and it must be expected that these prices will rise still further in the future. The lead used for cables is already being requisitioned in part, and it is feared that it will not be available in a very short time. The use of zinc cables

TABLE II—ELECTRICAL PROPERTIES OF WIRE MATERIALS

	Copper Wire	Aluminum	Zinc	Iron
Specific resistance at 20 deg. C. in ohm mm^2/m	0.0178	0.0306	0.0625	0.143
Conductivity at 20 deg. C. in Siemens m/mm^2	56.2	32.7	16.0	7.0
Conductivity calculated for copper in per cent	100	58.4	28.5	12.5
Coefficient of temperature for 1 deg. C.	0.004	0.004	0.0039	0.0057

TABLE III—LOADING TABLE FOR ZINC CABLES

HIGHEST PERMANENTLY ADMISSIBLE CURRENT IN AMPERES WHEN LYING IN GROUND

Cross-Section mm^2	Single Conductor to 750 Volts	Twisted Two-Conductor Cable to		Twisted Three-Conductor Cable to		Twisted Four-Conductor Cable to		Concentric Two-Conductor Three-Conductor to	
		3,000 Volts	10,000 Volts	3,000 Volts	10,000 Volts	3,000 Volts	10,000 Volts	3,000 Volts	3,000 Volts
1	12	10	...	9	...	8	...	...	...
1.5	16	13	...	12	...	10	...	...	...
2.5	22	17	...	15	...	14	...	...	...
4	29	22	...	19	...	18	...	...	...
6	37	28	...	25	...	23	...	...	...
10	50	37	34	35	32	30	29	37	29
16	70	50	48	45	42	40	37	48	40
25	90	65	60	59	56	53	50	65	53
35	110	80	75	70	65	65	60	75	65
50	135	100	95	90	85	80	75	95	80
70	170	120	115	105	100	100	90	115	100
95	205	145	135	125	120	115	110	145	115
120	240	165	155	145	135	130	125	165	135
150	270	190	175	165	160	155	145	190	155
185	305	215	200	190	180	175	165	215	175
240	355	250	...	225	..	205	...	250	205
310	420	290	...	260	...	235	...	295	240
400	485	340	...	305	...	...	...	345	380
500	555	...	...	...	...	...	...	...	...
625	635	...	...	...	...	...	...	...	...
800	740	...	...	...	...	...	...	...	...
1000	850	...	...	...	...	...	...	...	...

is not considered desirable except where absolutely necessary.

DWELLING-HOUSE INSTALLATIONS

Upon the suggestion of Director Schlebach of the Society of Middle-Rhenish Electrical Works, the regulations covering dwelling-house installations to be carried out during wartime have been revised by a committee of the society. Particular attention is called to the novel points of view concerning the calculation of mains covered by the regulations.

1. Only line material standardized or approved by the Society of German Electrical Engineers is to be used.

2. Higher losses of voltage than allowed so far are to be permitted in the installations as follows: Up to 5 per cent in lighting installations and up to 6 per cent in power installations. The cross-sections of mains are to be calculated, taking into consideration the voltage drop so far admitted, and the cross-sections thus obtained are to be multiplied by 2.5 for iron mains and by 1.5 for zinc.

3. In calculating the cross-section of the mains the following loading proportions are to be used as a basis:

(a) For lighting installations:

Feeder.—For one circuit, 6 amp. For dwelling houses with several circuits, 6 amp. for each circuit; as load for the feeder, however, only 75 per cent of the total connecting rating. For business houses and stores, for each circuit 6 amp. High candle-power lamps—i. e., over 50 cp.—must be calculated at their actual watt consumption.

Distributing Lines.—For dwelling and business houses each lamp provided shall be calculated at 40 watts, but high candle-power lamps shall be accurately figured.

(b) For power installations:

In the case of motors the power of the working current shall be calculated in lieu of the power of the starting current.

Submitting of plans:

These are to be simplified as much as possible, and for otherwise clearly defined and comparatively small installations in lieu of ground plans only switching diagrams or sketches should be required.

It has been agreed between the Society of Electrical Works and the manufacturers of insulated wires that hereafter all zinc wires insulated with rubber regenerate shall be identified with a special light-green standard thread.

The Selling of Electric Ranges in a Small Town

Why the Quick Campaign is Not Always Profitable—The Small Cost of Judicious "Cook-by-Wire" Publicity in the Sustained Sales Effort Being Conducted at Hood River, Ore.

By Albert S. Hall
Manager Hood River Gas & Electric Co.

The object of an electric-range campaign is not just to sell a few ranges. The real objective is rather to establish a business; to create the basis for a continuous and a satisfactory business, one which must be remunerative to the central station and, at the same time, popular with the public. The most important problem which confronts us, therefore, is to popularize the range and educate the public to the use of the electric range with a view to finally establishing it as a staple commodity, the same as the wood or coal range, without going into a high-priced campaign which will not be justified by the margin of profit which the business promises.

Certainly, this can be accomplished—for kerosene is cheaper than electric light, yet we have almost supplanted the old illuminant by exploiting the advantages of the new through educating the people to appreciate the benefits secured by the increased cost, and through making the service satisfactory and desirable. But central-station managers must not make the mistake of thinking that ranges can be sold just as they sell electric light or flatirons. It is a different situation that requires different treatment.

Campaign Methods Not the Best

It has been the experience of many companies that have actively promoted the electric range that customers for ranges obtained during a spirited selling campaign are very likely to be the ones least desirable to the lighting company, and least beneficial in building up a permanent business. They are the same kind of people that Billy Sunday converts. Some will remain converted. Some will not. And of those who do remain there will be many who are dissatisfied and will not be boosters for the range, even though they are obliged to keep it and continue to make use of it.

And since the profits from the electric range, even at present rates for electricity, are not overlarge, the industry had better abandon the opportunity entirely rather than start wrong and be compelled to nurse along its cooking customers after the equipment is sold. So in turning our attention to the growing opportunity for the development of a profitable electric cooking load in Hood River, we decided to avoid expensive campaign methods and try out, instead, a simple work of education that would gradually impress the subject upon the public individually, and win us customers by a gradual process of awakening interest and desire.

THESE SIGNBOARDS ARE ERECTED AT A COST OF $2 EACH

The basis for the campaign which was opened on March 1 consists of an advertisement on an "outlook" envelope, illustrated herewith, together with the use of the backs of the monthly bills and a system of signboard advertising. These mediums, taken all together, are actually producing considerable publicity. Every envelope we send out carries the message faithfully. The advertisement on the back of the bill reaches every customer each month. The addressee cannot avoid seeing it. Road signs dot the countryside bearing the slogan, "Cook by Wire"—keeping the subject continually in everybody's mind. At the same time, in the moving-picture theaters slides are shown at each performance, and so the "prospect" meets the thought again in his leisure moments. And the cost is small.

Economy of Hood River Plan

The advertisement on the envelope is printed at the same time as the return address, standard outlook envelopes being used, and no extra charge is made for the extra advertising. The statistical advertising on the back of the monthly bill is printed at an expense of $1 per 1000 bills in excess of the regular cost of printing the monthly bills. The signboards are of wood, measure 6 ft. long and 18 in. high, and are painted solid black, with a white border and lettering. Six of them have cost us $12 erected, or $2 each. These signs have been posted on the six main arteries of travel, and together with the above advertising we expect to run a slide in the motion-picture house continuously. Such a slide costs $3 per month. The total cost of the three units of advertising besides the envelopes is, therefore, as follows:

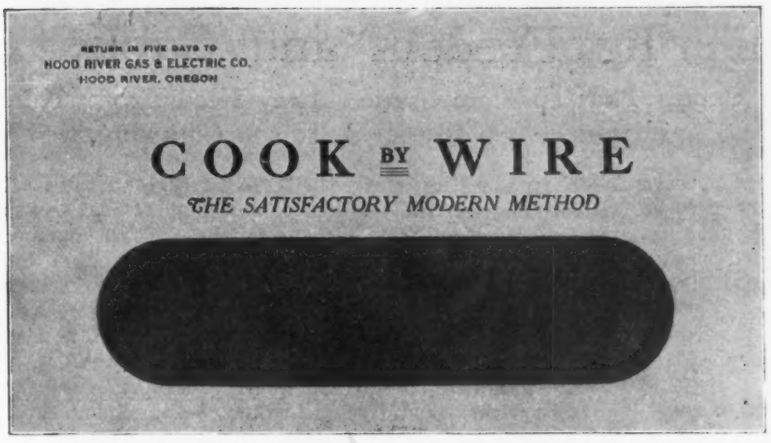
1000 bills monthly, annual cost	$12.00
Six signboards, figured as one year life	12.00
Picture-show slide, annual cost	36.00
Total annual cost	$60.00
Monthly cost	$5.00

A comparison of this class of advertising with newspaper advertising is interesting. The same $60 per year would pay for a half-page "ad" in one issue each month of a local newspaper, although by actual check we find that less than 500, or only about one-half, of our customers are newspaper subscribers.

Again, as compared with a range demonstration, the outlined campaign appears even more favorably, for a week's demonstration would cost from $200 to $350, or five times as much, and would reach a very small percentage of actual customers, and those only for a week.

We feel, therefore, that for every dollar expended we are getting a closer contact with our people and administering more impulse than we could in any other way. Moreover, we gain our converts slowly, as they are ready, and we can depend upon their satisfaction with the range and in our ability to follow the business through and give good service.

As in the electric lighting field the fundamental basis on which all the new business must be built is "service,"



COOK BY WIRE

THE SATISFACTORY MODERN METHOD

WHAT IT COSTS

ASK YOUR NEIGHBOR *NET BILLS*

NAME	August	September	October	November	December	January
Dr. F. C. Bronsu	$7.45	$7.45	$1.55	$1.00	$1.00	$1.25
Dr. H. L. Dumble			1.00	1.00	1.00	1.00
Albert S. Hall	4.20	2.15	4.35	7.00	5.10	4.45
Frank Howard	2.00	2.15	2.00	1.90	1.95	1.85
J. H. Heilbronner	7.90	3.05	4.20	4.20	3.35	4.00
R. B. Perigo	4.70	2.25	1.00	1.75	1.10	1.00
H. T. Parr	10.10	2.90	3.05	2.05		
H. L. Fording	7.70	3.60	1.00	1.35		
L. E. Look		4.25	2.45	2.05	1.90	1.00
W. N. Winter	3.50	4.00	3.10	2.45	4.95	
G. D. Woodworth	1.25	1.00	1.00	1.00	1.00	1.00
J. F. Batchelder				1.75	2.10	2.30
Three Ranges in Apartments of O. W. Telephone Co.	4.20	12.55	13.10	12.90	10.55	8.30

AVERAGE COST PER MONTH.....$3.04

We refer you to our patrons now cooking by electricity. We will appreciate the privilege of furnishing you with further information and details. *Come in and see the modern types of Electric Ranges.*

BOTH ENVELOPE AND BILL CARRY THE COOK-BY-WIRE MESSAGE

Inside, on the back of his monthly statement, the customer finds the interesting testimony concerning electric-range economy reproduced at the right.

except that in the range field "service" is an even more important factor. Any range in use which is not giving satisfaction is not only unremunerative to us, but is a positive and very serious handicap to any effort at future sales. It is, in fact, a permanent injury to the business by creating in the minds of the people that very skepticism which we strive to overcome, for one range giving unsatisfactory service will cost many times its value in work and advertising to overcome its bad effects. Far better would it be to have that range in the storeroom than in the service of a customer who is not satisfied.

Therefore, it is obvious that a range should not be sold to a customer unless that customer is financially able to buy it and use it, for inducing a customer to overrate a range is just commercial suicide. The measure of a "good prospect" for an electric range is his ability to buy and use it, and the method of selling to anyone who can be induced to buy, though it may produce the desired results in the sale of automobiles or sewing machines, where the seller has nothing further to do with the machine after it is delivered, cannot be countenanced where the future of a great business depends upon successful continuous operation. In the case of ranges the continuous operation after sale is our only object, for we cannot consider the sales profits to any great extent. Neither should a range be sold until the customer knows something about it, or has satisfied himself as to the merits of electric cooking and the cost of operating the appliance. Any representations made by the salesman as to operating costs, etc., can, of course, be misconstrued, and often will be viewed with suspicion; but, on the other hand, if the prospective customer can be referred or taken to homes where ranges are already in use and giving satisfactory service, he will be convinced more easily and will have no reason to say afterwards that the electric company misrepresented the service-cost to him. This emphasizes the need of seeing that every range in service is satisfying its owner and that every customer is a "booster," for only then is the foundation laid for a campaign. If this foundation has not been laid then all possible effort should be made at once to get every situation straightened out, because one dissatisfied user can easily overcome the work of one good salesman.

So too much emphasis cannot be laid on this feature of the business. Every range should be visited regularly, and no effort spared to keep it in efficient and satisfactory condition. The salesman's first work should be to keep his customers happy and then to sell more ranges by their aid and co-operation. Also, close personal attention to the ranges in service not only benefits the central station from a commercial standpoint, but it enables the salesman to study the problems which arise in every-day operation and find out how to meet them. It gives him the opportunity to use his customers' experience in his own business, and to make the experience of each customer available to all the others. Moreover, it aids the central station in keeping down complaints, for the salesman by close personal supervision will discover the defects in our partially developed ranges of to-day, and be able to advise the manufacturer; and obviously the manufacturer must eventually look to the central station man for his advice in building ranges which suit the customer.

IMPORTANCE OF CONTINUOUS USE

One of the greatest problems to be overcome at this stage of the range business is to get the customers to use them continuously throughout the year, for unless they are used for a large portion of the year they are not profitable for either customer or company. The salesman who follows his ranges closely is able to seize the opportunity, which sooner or later will arise, to remove the wood or coal stove from the premises, and thus establish the electric range on a satisfactory basis. The months of April, May and June bring the best opportunity for the elimination of these old stoves, and, therefore, this matter should be watched very closely during the next months.

One very good plan we find for securing range customers is the installation of cooking rate circuits for light cooking by hotplates, used in conjunction with other appliances. In this way the customer becomes accustomed to cooking by electricity in a small way, and whenever his means will permit he will put in a real range. The fact that such a cooking circuit returns only $1 to $1.50 per month means nothing, because even at that it is much more remunerative in proportion to its demand than is the regular range, with a demand of several kilowatts.

The restaurant and hotel cooking field, of course, promises to be one of the best markets for future electric cooking activity. For while the average residence electric range, on the 4 cent rate, produces much less revenue per kilowatt of demand than the same service would if placed on our power rates, the restaurant and hotel business has a load factor such that our standard power rates are much cheaper than the cooking rate, and the business is profitable to both customer and company on power rates. One complete electric restaurant in our territory produces an annual revenue of $57.88 net per kilowatt of five-minute maximum demand, the maximum demand being 5½ kw.

System for Numbering Feeders and Cables

Methods of Assigning Numbers to Cables That Indicate Station They Feed From, Kind of Service and What They Feed, as Used by the Brooklyn Edison Company

IN selecting a system for numbering feeders of a large distribution system, many factors have to be taken into consideration. The number should indicate the kind of feeder, and give a very good idea of its function, such as its feeding point, what it feeds, etc. The system, however, should be as simple as possible. The tags used to mark the cables in the manholes, etc., must be easily read, permanently fastened to the cables and preferably indicate by their shape the kind of current carried by the cable. Such a system of designating feeders has been devised by the Edison Electric Illuminating Company of Brooklyn.

The company has two generating stations which furnish 6600-volt, three-phase, 25-cycle alternating current energy. These two stations have fifty-six underground feeder cables which run to eighteen substations, and several large customers. In addition to these three-phase feeders, there are thirty-two others, which are either ties between substations or run from substations

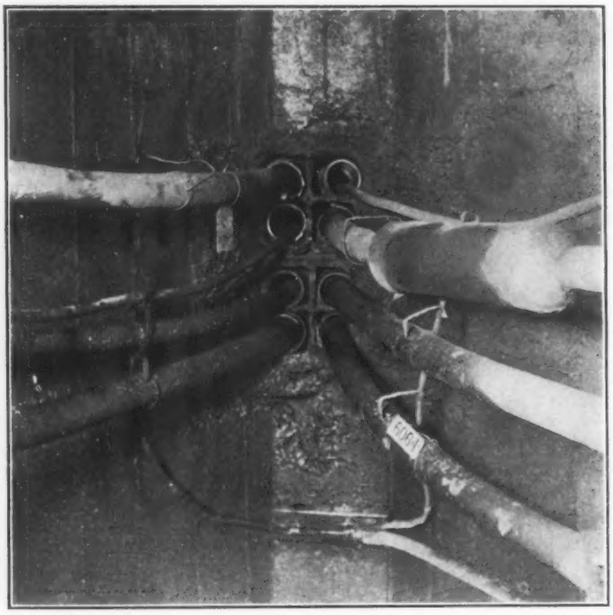


FIG. 1—METHOD OF TAGGING FEEDERS AND CABLES, SHOWING TWO-PHASE TAG ON CABLE AT LEFT AND THREE-PHASE TAG ON ONE AT RIGHT

to large customers. These substations convert the three-phase current into 120-240-volt direct current in the congested sections of the city, and into 2400-volt, two-phase, 60-cycle alternating current in the outlying sections. The distribution of the 120-240-volt direct-current energy is by use of two conductor 1,000,000-circ. mil concentric cables leading from the substations to junction boxes, which connect these feeders to the network of the direct-current mains. A few old Edison tube feeders are still in use, but are rapidly being replaced by concentric cables. Separate cables are run for the neutral and for pressure wires. The distribution of the 2400-volt, two-phase, 60-cycle alternating-current energy is by a four-wire system. A special cable, No. 2-0-B & S gage, four-conductor, is standard for the underground portion of these feeders, while separate wires are run for the overhead portion. No. 4 B & S gage rubber and lead cable is used for underground high-tension lighting circuits.

The generating station at Gold Street and the East River is given the number 6, and that at Sixty-sixth Street and New York Bay the number 7. The number 8 is to be used for a future generating station, and the number 9 is used to designate a three-phase feeder which is a tie between substations or one which runs from a substation to a customer. The number 5 is used as a number for the New York Edison Company.

The numbers from 00-29 inclusive are reserved for direct-current substations, of which 00-14 inclusive have been used.

The numbers from 30-99 inclusive are reserved for alternating-current substations and three-phase customers, of which 30-47 inclusive have been used.

The substations and three-phase customers are numbered as follows:

DIRECT-CURRENT SUBSTATIONS

00—Pearl Street.
01—Rockwell Place.
02—Lexington Avenue.
03—Lorimer Street.
04—Carroll Street.
05—Ainslie Street.
06—Sumpter Street.
07—Atlantic Avenue.
08—Myrtle Avenue.
09—Hall Street.
10—West Twelfth Street.
11—Gold Street.
12—Brighton Beach.
13—Madison Street.
14—Jay Street.

ALTERNATING-CURRENT SUBSTATIONS AND THREE-PHASE CUSTOMERS

30—Hicks Street.
31—J. R. Robins Dry Dock Company.
32—Thirty-second Street.
33—Tidewater Paper Mills Company.
34—Forty-second Street.
35—Morse Dry Dock & Repair Company.
36—St. Edwards Street High-Pressure Water Pumping Station.
37—Joralemon Street High-Pressure Water Pumping Station.
38—Kings Highway.
39—American Manufacturing Company.
40—Bay Ridge Ice Company
41—India Wharf Brewing Company.
42—J. H. Williams & Company.
43—Lidgewood Manufacturing Company.
44—Gowanus Pumping Station.
45—Governors Island.
46—Tunnel Shaft No. 1.
47—E. W. Bliss Company.

THREE-PHASE FEEDERS

Each three-phase feeder number consists of four digits and must be between 5001 and 9999. The digits have the following significance:

First digit: Indicates whether a feeder runs from Gold Street generating station, Sixty-sixth Street generating station, New York Edison Company, from a substation to a customer, or is a tie feeder between substations.

Second and third digits: Indicate the substation or customer to or from which a feeder runs. Tie feeders use the number belonging to the substation from which they feed.

Fourth digit: Indicates whether a feeder is the first, second, third, etc., feeder between the stations given by the first three digits.

As an example, take a feeder running from Gold Street generating station to Ainslie Street substation. Its number is 6051. If there is a second feeder between the same stations, its number is 6052, etc. A feeder running from Sixty-sixth Street generating station to Ainslie Street substation is number 7051, etc. In numbering tie feeders and feeders running from a substation to a customer, it is not possible to give the stations between which it runs, as in the case of one running from a generating station to a substation or customer. In such a case only one of the stations between which the feeder runs can be shown in the number of the feeder, and the station number shown is the one from which the feeder would be fed under normal conditions. For example, take a tie feeder running from Myrtle Avenue substation to Madison Street substation. Such

a feeder would normally be fed from the Myrtle Avenue end, hence its number would be 9081. Any feeder whose number begins with a 9 and has four digits is a three-phase feeder, either a tie between substations or runs from a substation to a customer.

In a few cases a three-phase feeder consists of two cables in multiple. When such is the case the additional cable is distinguished in the subway by the letter "A" being added to the number. This letter does not show on the number on the switchboard.

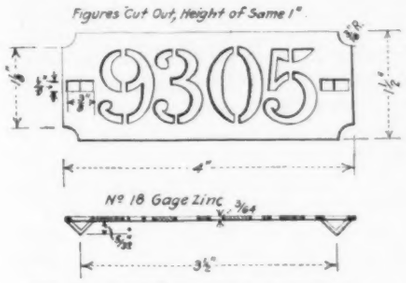


FIG. 2—THREE-PHASE FEEDER TAG

This system has the limitation that it will cover only nine feeders from one generating station to any particular substation, or from any substation to other substations or customers without using five digits. The limiting of the number of digits to four was the factor given the most weight in determining on a system. It is possible, but not probable, that five digits will ever have to be used to designate a feeder.

There are four exceptions to this scheme of numbering, namely, three feeders which connect with the New York Edison Company which have numbers assigned them by the New York Edison Company as follows: 5210, 5218 and 5235. The other exception is a feeder which connects with the Brooklyn Rapid Transit Company's system, and has the number 502 assigned to it by that company.

DIRECT-CURRENT CABLES

The direct-current feeder numbers indicate the substation they feed from. Direct-current feeders must be numbered between 1 and 2999 (29 is the highest possible number of any direct-current substation). There are available ninety-nine numbers for each substation. Thus, Rockwell Place substation (Station 01) has the numbers 101-199 inclusive assigned to it; Myrtle Avenue substation (Station 08), the numbers 801-99 inclusive; Pearl Street substation (Station 00), the numbers 1-99 inclusive, etc. Thus 107 is a direct-current feeder fed from Rockwell Place substation, 516 one fed from Ainslie Street substation, etc. The direct-current neutral feeders are tagged "Nu," standing for neutral.

The pressure wire cables are numbered with the number of the feeder they connect to, with the addition of the letters "P. W." after the number. When a pressure wire cable contains enough wires to read pressure on two or more feeders, the tag shows the number of each.

Thus it is seen that it is only necessary to remember the numbers of the generating and substations and the general plan of numbering in order to know from its number whether a cable is a three-phase feeder, a direct-current feeder, or a pressure wire, and also its function in the distribution system. As a help in remembering the numbers enamel signs reading "Station No. —" have been put on the doors of all stations.

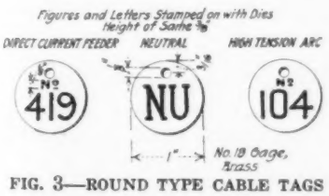


FIG. 3—ROUND TYPE CABLE TAGS

The 2400-volt, two-phase feeders are given names, not numbers which, when the feeder is first installed, is the name of the principal street fed by the feeder. Thus "Manhattan" supplies Manhattan Avenue, and "33rd St." supplies Thirty-third Street, etc. It has been proved by experience that giving these feeders names is very satisfactory, as in addition to giving a very good idea of their route, the names clearly distinguish these feeders from any other kind of feeder. This is of great importance, as 2400-volt feeders are worked on alive when necessary, underground as well as overhead. There is only one exception to naming these feeders, and it is where two 2400-volt feeders feed only one customer, a large factory, Hanan & Company, and these are known as Hanan No. 1 and Hanan No. 2.

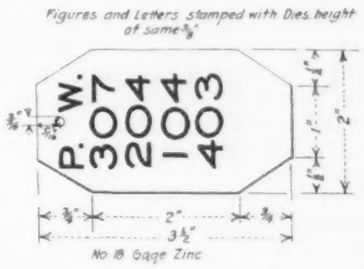


FIG. 4—PRESSURE WIRE CABLE TAG

The high-tension series circuits are numbered somewhat arbitrarily, the chief consideration being to give them numbers so that there will not be two cables in the same duct-run or manhole with identical numbers, and still have all street lighting circuits out of one station with same first digit. Three digits are used for these circuits. These circuits are slowly being superseded by low-tension multiple circuits, so the old system started years ago has not been changed. At present the following are the numbers of high-tension series lighting circuits:

Substation Fed From	Numbers Inclusive
Ainslie Street	101 to 110
Sumpter Street	201 to 208
West Twelfth Street	301 to 307
Hicks Street	501 to 503

The overhead low-tension multiple street lighting circuits are numbered from 1 up. These circuits are controlled by switches on poles. An index showing switch location accompanies each set of multiple street lighting circuit prints.

FEEDER TAGS

Different shaped tags are used for different kinds of feeders. In tagging three-phase feeders, an 18 gage zinc tag is used, shaped as shown in Fig. 2. The numbers are cut out, and are 1 in. in height. These tags are fastened to the cables by two pieces of string solder, which pass through slots at each end of the tag.

Direct-current feeders, neutrals and lighting cables are tagged with a round brass tag, on which the number is stamped with a die. These tags are fastened to the cables by a copper wire.

Pressure wire cables are tagged with a small "tag-shaped" 18-gage zinc tag with no square corners, such as shown in Fig. 3.

Two-phase feeders are tagged with a "tag-shaped" zinc tag, 18 gage with two square corners, on which the numbers are stamped with a die, as shown in Fig. 5. These are fastened to the cable in the same manner as the round tags. The tags for the pressure wire and two-phase cables are very similar. This creates no confusion as the pressure-wire tags have numbers on them, while the two-phase tags have names on them. Pressure wires and two-phase cables do not run in the same subways except in a few cases, which also avoids confusion.

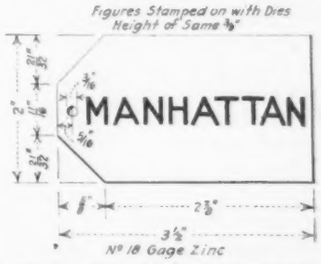


FIG. 5—TWO-PHASE FEEDER TAG

A Coupon Purchase Plan for Lamp Renewals

Details of a System Now in Use in Summit, N. J., by Which the Lighting Customer Buys His Lamps from the Central Station, Receiving With Them Coupons Applicable on His Bills for Electricity

BY S. W. BORDEN

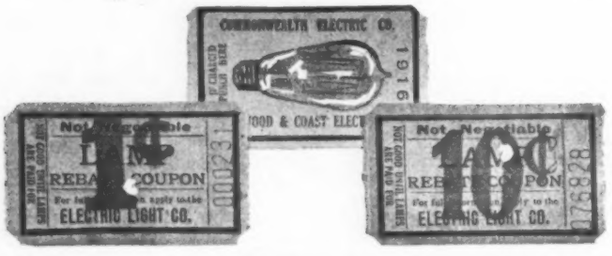
Manager Commonwealth Electric Company, Summit, N. J.

AFTER a careful study of the problem of customers' lamp supply in all its phases, we have developed and adopted here in Summit a plan of allowances by coupon on the purchase of all tungsten-lamp renewals that is proving a most satisfactory solution of the difficulty.

When the customer purchases a tungsten lamp at the company's office, at the same time returning a burned-out lamp of approximately equal wattage, he receives with the new lamp a "lamp coupon." These coupons are applicable in payment of the customer's monthly bill for electricity and have the following values for lamps of various sizes.

Standard Tungsten Lamps		Gas-Filled Lamps	
Size of Lamp	Value of Coupon	Size of Lamp	Value of Coupon
10 watt	$0.04	100 watt	$0.50
15 watt	.06	200 watt	1.00
20 watt	.08	300 watt	1.50
25 watt	.10	400 watt	2.00
40 watt	.16	500 watt	2.50
60 watt	.24	750 watt	3.75
100 watt	.50	1000 watt	5.00
150 watt	.75		
250 watt	1.25		

The burned-out lamps turned in must be of about the same total wattage as the new lamps, but may be of either the tungsten, graphitized or carbon-filament type. The coupons received by the customer are issued in denominations of 10 cents, 5 cents and 1 cent, and may be used in part payment of electricity bills on the



THESE COUPONS, IN DENOMINATIONS OF ONE, FIVE AND TEN CENTS, ARE ISSUED TO CUSTOMERS WHEN LAMPS ARE BOUGHT, AND ARE REDEEMABLE IN PART PAYMENT OF MONTHLY LIGHTING BILLS

company's standard residence or commercial lighting rate, providing that not more than 10 per cent of any one month's bill is paid in coupons. If the customer has more than 10 per cent worth of coupons, the excess may be used in the payment of later bills.

No coupons are exchanged for cash, except for making change for a 5-cent coupon. If lamps are not paid for at the time of purchase the coupons do not become redeemable until the lamps have been paid for. In case customers neglect to return the old lamps at the time of purchase, coupons are not issued until the old lamps are received. When lamps are delivered a reasonable charge is made for the special service, and the amount is deducted from the coupons. Where lamps are delivered by parcel post, the cost of the postage stamps is similarly deducted. In this way the situation is kept thoroughly in hand.

Readers of the ELECTRICAL WORLD are no doubt familiar with the history of the incandescent lamp renewal practice, but it is interesting to consider how the custom has evolved and how it is affected by this plan.

The free-renewal idea was first taken up by central stations, I think, with the idea of controlling the lamp supply, not because they desired to sell lamps for the profit derived from the business but because they wished to make sure that their customers used good lamps. In order to do this they were practically obliged to give free lamp renewals and, naturally, as the practice grew, the rates were made to take care of the cost of these renewals.

In order to keep the renewal cost within bounds the companies generally etched their lamps with their initials or some other mark, and would renew only lamps so marked. But in addition to these troubles there were always chances for an argument with the customer as to whether or not the lamp was entitled to renewal, the customer frequently presenting broken lamps, lamps of inferior quality bought outside at a low figure, or lamps which had seen very little service—and demanding that they be renewed.

If a company adopted a too liberal policy the cost was excessive. If the policy was not liberal enough the results were not satisfactory to anyone.

It was with the lamp-renewal proposition in this stage that the metal-filament lamp was placed on the market. At first it did not occur to anyone that a customer should receive a free renewal of a lamp of this type, but as these lamps became more generally used and the price became lower the desirability—if not the actual necessity—for some kind of a renewal proposition covering this type of lamp became evident for several reasons.

In the first place, as before stated, the rates being charged for energy consumed in lighting really entitled the customer to a certain allowance for lamp renewals. In addition to this the customers had been accustomed to lamp renewals, and as they changed from the old lamps to the new they soon began to rebel at the loss of their renewal privileges. Another reason was that the lack of free renewals was actually retarding the introduction of the lamp, and most companies were looking at the metal-filament lamp in a broad way and believed in encouraging its use.

Then, in addition to these arguments, the old reason still remained—that there were good and bad metal-filament lamps just as there were good and bad low-efficiency lamps, and if the free renewal proposition was desirable for one it was desirable for the other.

So with tungsten and other high-efficiency lamps costing considerably more than the older types, and being, furthermore, somewhat more liable to breakage, and considering in addition the defects of the existing lamp-renewal system, it was felt that a somewhat better method of taking care of the renewal practice could be devised.

After a careful study of the situation we adopted the coupon system already described above, and after four months' operation we find this plan very satisfactory, although we would say that four months is not long enough to judge it fully. The accompanying tables, however, are of interest in showing about how the cost should work out; and our experience so far seems to justify these figures.

It should be noted that in determining the quantity "cents per kilowatt-hour," the number of kilowatt-hours used are those that would be consumed by that particular lamp if burned for 1000 hours, but including no energy not used by the renewed lamp. If we should use the kilowatt-hours as registered on the meters of our lighting customers, the "cents per kilowatt-hour" would be much lower, due to the fact that these meters are used to register not only the energy consumed by the free-renewal lamps, but all the energy used by the customer, which includes that consumed by non-renewable lamps, heating devices, etc. It is, therefore, very difficult to arrive at a value for the "cents per kilowatt-hour" other than by assuming a given life for the renewed lamp. It should also be noted that this cost covers only the invoice price of the lamp and does not cover any costs of handling, delivery, etc.

Applying the figures given for graphitized lamps on the "lamp-for-lamp" basis, we find that the average cost for a graphitized lamp renewed by this company over a period of ten months amounted to 31 cents per kilowatt-hour, whereas it is generally conceded that graphitized-lamp renewals cost somewhat more than this. It is therefore well to assume that the figures given under "cents per kilowatt-hour" are, perhaps, 25 per cent below the actual total cost of free renewals of the graphitized lamps under the "lamp-for-lamp" system.

While this 25 per cent correction would undoubtedly apply as well against the tungsten-lamp renewal cost if renewed on the "lamp-for-lamp" basis, it will probably be fully offset by economies obtained by the use of the coupon system. It is therefore probable that the "cents per kilowatt-hour," as given for tungsten lamps under the coupon system of renewal, is a fairly accurate estimate of the total cost, on the coupon system, in cents per kilowatt-hour, of the energy used by these lamps.

The figures given under the heading "percentage of bill at 10 cents per kilowatt-hour" will vary, of course, in the same ratio as the "renewal cost in cents per kilowatt-hour," being equal to 10 times the latter.

ADVANTAGES OF THE COUPON SYSTEM

We have found that this coupon system has a great many very worth-while advantages. Under almost any conceivable condition, involving fraud or otherwise, a customer can get free lamps only to the value of 10 per cent of his lighting bill, that is, 10 per cent of a bill which is incurred at lighting rates; and while it is true that only a part of this energy might actually be consumed by lighting devices, it is also true that the customer is perhaps entitled to this reduction on any bill figured at the lighting rate, since the lighting rates contain, to some extent, an allowance for lamp renewals. A customer can receive no free lamp renewals except by using, at lighting rates, an amount of energy equivalent to that necessary to consume the useful life of the lamp, and only then upon condition that he pays for that energy. Thus practically all questions in regard to whether or not a lamp is subject to renewal are eliminated, since by this system the company has very little chance of loss in renewing almost any type of lamp in almost any condition. As a matter of fact, if it were not for the fact that we desire to have the customer pay for the first installation of lamps it would not be essential that any old lamp be returned at all, although it would still be desirable.

With the coupon system we find that we are also able to keep a very much better check on our entire lamp situation. Lamps used to leak out in one way or another, or perhaps were broken by careless handling, and they were all simply charged to lamp renewals, and in that way covered up. With the present system no renewals are given except through the medium of the coupon, and the total of these cancelled coupons must always check with the lamp-renewal accounts.

In addition the contribution which the company makes toward the renewal cost varies directly with the life of the lamp, and for an assumed life of 1000 hours is equal to 0.4 cent per kilowatt-hour on the lamps below 100 watts, and five-tenths of a cent per kilowatt-hour on lamps of 100 watts or larger. As stated, this does not vary with the type of lamp or its cost or its selling price. This is a considerable advantage where a number of lamps of various types, finishes, bulb shapes, etc., are handled, all involving different prices. It will be noted, also, that the selling price of the lamps is kept at a point which represents a fair profit in the smaller sizes, and while this system insures to the central station a pretty thorough control of the lamp situation, it nevertheless does not entirely remove the electrical contractors from the lamp sales business.

In practice the scheme is working out very nicely, the actual transaction at the cashier's window being simple and not inconvenient. The customer applies at the lamp desk, for example, for ten 40-watt lamps. These she receives, and for these she is charged $2.50 less 10 per cent. If she pays cash and returns old lamps, she receives coupons worth $1.60, and if she wishes the lamps charged she receives the same coupons, except that they are punched. If, as is usually the case, she has her electric light bill with her for payment, she immediately pays 10 per cent of the bill with coupons and retains the

TABLE I—COST OF RENEWALS—LAMP-FOR-LAMP BASIS

Type	Watts	Cost	Selling Price	Net	Cost to Renew	Percentage of Lamp Cost	Percentage of Bill at 10 Cents per Kw.-hr.	Cents per Kw.-hr. (1000 Hours' Life)
Graphitized	10	$0.13	$0.18	0	$0.13	100	13.0	1.30
	30	0.13	0.18	0	0.13	100	4.0	0.40
	60	0.13	0.18	0	0.13	100	2.2	0.22
Hylo*	40–10 (8-½cp.)	0.40	0.25	0	0.40	100	8.0	0.80
	60–15 (16-1 cp.)	0.40	0.25	0	0.40	100	5.3	0.53

*Estimated average consumption during life of lamp as follows: 8 to ½ cp, 50 kw-hr. 16 to 1 cp, 75 kw.-hr.

TABLE II—COST OF LAMP RENEWALS—COUPON SYSTEM

Type	Watts	Type	Cost	Selling Price	Coupons	Net	Cost to Renew	Percentage of Lamp Cost	Percentage of Bill at 10 cents per Kw-hr.	Cents per Kw.-hr. (1000 Hours' Life)
Tungsten	10	B	$0.175	$0.25	$0.04	$0.21	$0.000	....	.....	.....
	15	B	0.175	0.25	0.06	0.19	0.000	....	.....	.....
	20	B	0.175	0.25	0.08	0.17	0.005	3	.25	0.025
	25	B	0.175	0.25	0.10	0.15	0.025	14	1.0	0.10
	40	B	0.175	0.25	0.16	0.09	0.085	49	2.1	0.21
	60	B	0.235	0.25	0.24	0.01	0.225	96	3.7	0.37
	100	B	0.420	0.50	0.50	0.00	0.42	100	4.2	0.42
	100	C	0.650	0.75	0.50	0.25	0.40	62	4.0	0.40
	150	B	0.680	0.75	0.75	0.00	0.68	100	4.5	0.45
	200	C	1.30	1.50	1.00	0.50	0.80	62	4.0	0.40
	250	B	1.10	1.20	1.25	0.05	1.15	105	4.6	0.46
	300	C	1.95	2.25	1.50	0.75	1.20	62	4.0	0.40
	400	C	2.60	2.75	2.00	0.75	1.85	71	4.6	0.46
	500	B	2.50	2.50	2.50	0.00	2.50	100	5.0	0.50
	500	C	2.93	3.25	2.50	0.75	2.18	75	4.4	0.44
	750	C	3.90	4.50	3.75	0.75	3.15	81	4.0	0.40
	1000	C	4.55	5.25	5.00	0.25	4.30	95	4.3	0.43
Graphitized	10	..	0.13	0.18	0.04	0.14	0.00	....	.....	.....
	30	..	0.13	0.18	0.12	0.06	0.07	54	2.3	0.23
	60	..	0.13	0.18	0.24	0.06	0.19	146	3.1	0.31
Hylo	40–10 (8-½ cp.)	..	0.40	0.25	0.16	0.09	0.31	77	6.2	0.62
	60–15 (16-1 cp.)	..	0.40	0.25	0.24	0.01	0.39	97	5.2	0.52

others to apply against future payments. The cashier will not honor punched coupons until the lamps for which they were issued have been paid for.

This routine might at first appear to involve considerable work, but we find that it is not a very serious matter to check payment, since a given customer's purchases of lamps are few, seldom being more than one in one month. Furthermore, the customer soon becomes familiar with the system and pays cash for lamps. The cashier simply turns in all the coupons to the treasurer as so much cash, and they are then charged against the lamp-renewal account.

We are thoroughly satisfied that the plan is a good one, but hope that the readers of the ELECTRICAL WORLD will feel at liberty to comment on it or to criticise it freely, if in the light of their experience it seems to offer on the one hand objections, or on the other opportunities for further application.

Properties of Reactor with Iron Core and Air Gap

Derivation of Simple Equations for Calculations of Reactor Characteristics and Data for Particular Design

BY SHIRO SANO

IN designing a reactor for purposes of general experiments with alternating currents it is frequently necessary, in order to reduce the weight of copper required, to use an iron core. By providing an air-gap in the iron circuit the reactance of such a reactor can be adjusted to any desired value within comparatively wide limits. In this case the exact calculation of the reactance of the coil will be found to be highly difficult, owing to a number of unknown items entering into the computation, the chief of them being difficulty of determining the exact path of the magnetic flux and its density along the path. In particular cases, however, sufficiently accurate results for practical purposes may be obtained by relatively simple assumptions.

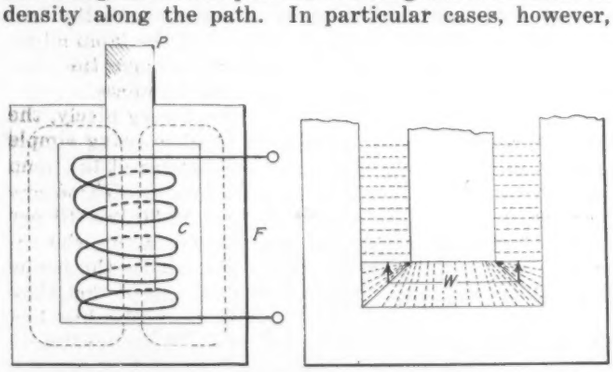


FIG. 1—GENERAL DESIGN OF REACTOR CONSIDERED. FIG. 2—DISTRIBUTION OF FLUX BETWEEN PLUNGER AND FRAME

The author has succeeded in deriving a set of rather simple equations for the calculation of the reactance of one form of construction, the validity of which equations has been repeatedly proved by actual experiments. Fig. 1 shows the general construction of the reactor. C is a coil into which fits a movable plunger P. F is a framework of sheet iron, which serves to define the path of the magnetic flux and also to reduce the reluctance. The path of the main flux is shown by the dotted lines. Along with this main flux there will also be a leakage flux between the plunger and the framework. The dotted lines in Fig. 2 show this leakage flux.

DERIVATION OF EQUATIONS

The total counter-emf. offered by the reactance coil may be considered as made up of two components, the emf. induced by the alternation of main flux and the emf. due to the alternation of the leakage flux. The two emfs. will be in phase with each other, and hence the total counter-emf. is the simple arithmetical sum of the two.

Referring to Fig. 3, the leakage flux through the elementary area is proportional to the ampere turns linking the dotted lines through dx. These ampere turns are

$$\frac{x}{L}N, \tag{1}$$

where N is the total turns of the coil. Hence, the leakage flux through Cdx from both sides of the plunger, neglecting the reluctance of the iron frame, is proportional to

$$2\frac{x}{L}N\frac{kC}{B}dx, \tag{2}$$

where k is a kind of "dispersion coefficient," to take

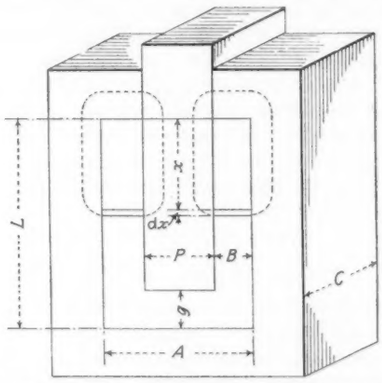


FIG. 3—CONSTRUCTION REFERRED TO IN THE CALCULATIONS

care of the spreading of the section of the flux path at B. The emf. induced by the alternation of this elementary flux will be proportional to

$$\left(2\frac{x}{L}N\frac{kC}{B}dx\right)\times\left(\frac{x}{L}N\right)=\frac{2kN^2Cx^2}{L^2B}dx. \tag{3}$$

Accordingly, the total induced emf. due to the leakage of flux is proportional to

$$k\frac{2N^2C}{BL^2}\int_0^{L-g}x^2dx=\frac{2}{3}\cdot\frac{kCN^2}{BL^2}(L-g)^3, \tag{4}$$

where g is the length of the air-gap between the plunger and the frame.

The main flux at the gap g may be considered to assume the distribution shown in Fig. 2. In this case the main flux is proportional to

$$N\left[C\left(\frac{A+P}{2}+g\right)k\right]\frac{1}{g}. \tag{5}$$

Hence the emf. induced by the alternation of this flux is proportional to

$$N^2\frac{1}{g}\left[C\left(\frac{A+P}{2}+g\right)k\right]. \tag{6}$$

Thus the grand total emf. induced in the coil is propor-

tional to the sum of equations (4) and (6), that is, proportional to

$$N^2Ck\left[\frac{2}{3}\cdot\frac{(L-g)^3}{BL^2}+\left(\frac{A+P}{2}+g\right)\frac{1}{g}\right] = N^2Ck(K_l+K_m), \quad (7)$$

where K_l and K_m stand for the items in the brackets respectively.

The ratio of the emf. due to main flux to the total emf. is thus,

$$\frac{K_m}{K_l+K_m}, \quad (8)$$

where

$$K_m=\frac{A+P}{2g}+1 \text{ and}$$

$$K_l=\frac{2}{3}\cdot\frac{(L-g)^3}{BL^2}.$$

After knowing this ratio, the calculation of exciting current is an easy matter.

As a numerical example, consider a reactor having the following dimensions, the air-gap being adjustable:

$N = 195.$	$L = 7\frac{5}{8}$ in.
$B = 2\ 3/16$ in.	$P = 2\frac{1}{2}$ in.
$A = 6\frac{7}{8}$ in.	$C = 2\frac{1}{2}$ in.

Impressed voltage = 124 volts. Frequency = 50 cycles.

The value of k can be determined experimentally and is usually about 1.15. The value may be computed under certain assumptions, but it seems to the author that the increased complication does not warrant a slightly more exact result.

Take $g = 2$ in., then

$$K_l=\frac{2}{3}\cdot\frac{(L-g)^3}{BL^2}=1.07,$$

$$K_m=\left(\frac{A+P}{2}+g\right)\frac{1}{g}=3.35,$$

and therefore

$$\frac{K_m}{K_l+K_m}=0.76.$$

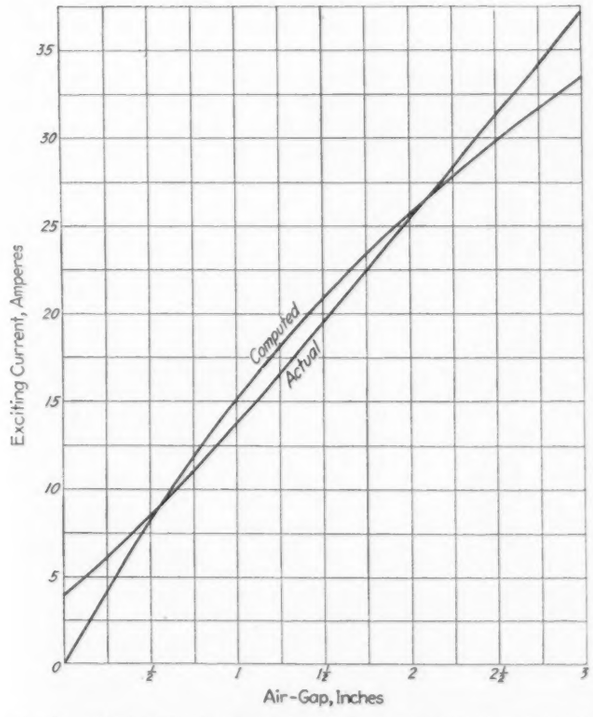


FIG. 4—COMPUTED EXCITING CURRENTS FOR VARIOUS AIR GAPS COMPARED WITH ACTUAL VALUES

Hence the voltage available for the main flux is

$$124\times 0.76 = 94 \text{ volts.}$$

The area of the main flux path is

$$C\left(\frac{A+P}{2}+g\right)k = 19.3 \text{ sq. in.}$$

The same value of k is here used as above (i. e., 115). For $N = 195$ and frequency = 50 cycles, the mean flux density in the air-gap is

$$B=\frac{94\times 10^8}{4.44\times 19.3\times 195\times 50}=11{,}200 \text{ lines per sq. in.}$$

Hence the ampere turns (effective value) are

$$\frac{11{,}200\times 2\times 0.3132}{1.41}=5000,$$

and therefore

Exciting current = $5000 \div 195 = 25.6$ amp.

In the table are given the excitive current for various air-gaps calculated by the method above described and also the actual observed value of the exciting current.

EXCITING CURRENT FOR AIR-GAPS

Air-Gap g, in Inches	Amperes	
	Computed Value	Actual Value
0	0	4.2
0.5	8.2	8.5
1	15.1	13.3
1.5	20.8	20.0
2	25.6	25.2
2.5	29.8	30.9
3	33.4	37.2

Fig. 4 shows the graphs constructed from the data in the table. It will be seen from the figure that the formulas are fairly accurate at least within and near the limits given by the two intersections of the "computed" and "actual" curves.

EFFECT OF SIDE CLEARANCE

Ordinarily the clearance between the plunger and the entrance to the frame can be made sufficiently small so that the effect of this air-gap may safely be neglected. However, when the main air-gap is small, the effect will be appreciable. The following method of computing this effect will be found useful for certain cases where accuracy is needed for small values of g:

The total flux passing through the air-gap forming the side clearance is the sum of the leakage flux and the main flux. The former is integral of equation (2); that is,

$$2\frac{N}{L}\cdot\frac{kC}{B}\int_0^{L-g}xdx=\frac{N}{L}\cdot\frac{kC}{B}(L-g)^2. \quad (9)$$

Thus the total flux is, adding equation (5) to the above,

$$NkC\left[\frac{(L-g)^3}{LB}+\left(\frac{A+P}{2}+g\right)\frac{1}{g}\right]. \quad (10)$$

Hence the ratio of total flux to main flux is

$$1+\frac{(L-g)^2}{LB}\cdot\frac{2g}{A+P+2g}. \quad (11)$$

In this way, if the main flux is found, the total flux can be calculated from the dimensions of the structure, and the necessary ampere turns are accordingly computed by the ordinary method.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Heat Distribution Balance for Diesel Engines

Fuel and Exhaust Gas Analyses and Jacket Cooling Water Data for Different Engine Loads

By R. H. Burdick

Engineering Department, Electric Bond & Share Company

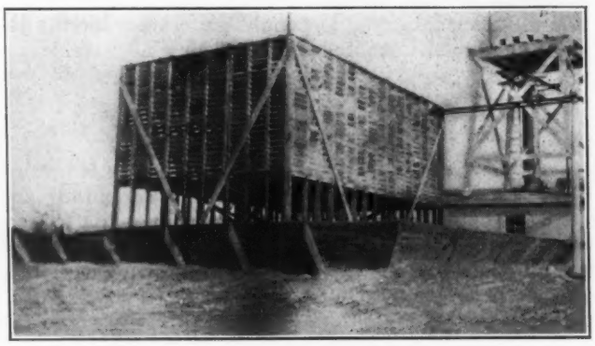
Tabulated herewith is a heat distribution balance for three 500-hp. Diesel-engine-driven generator sets at Paris, Tex. The figures of Table I are based on accompanying data and the durations of tests, fuel consumptions and kilowatt-hour outputs presented in an elaborate article on the "Performance of Diesel-Engine Plants in Texas," which appeared in the March 11 issue of the Electrical World. Aside from the mere determining of the general characteristics and economies to be effected by the operation of Diesel-engine power plants, these tests in connection with those previously published have a secondary use of serving as a basic guide for future design of major and auxiliary equipment of similar installation.

In connection with the heat balance it may be pointed out that the average thermal efficiency at full and three-quarters load was about 29 per cent, and at half and one-quarter loads about 25 per cent and 18.6 per cent respectively. The heat absorbed by cooling water represented about 35 per cent of the energy input to the engines at full and three-quarter loads. At one-quarter load the heat absorbed by the cooling water was about 53 per cent of the energy input.

The heat loss attributed to friction, generator losses, radiation and exhaust gases is made up chiefly of that lost through exhaust gases. This follows since generator efficiency averaged 92.6 per cent at full load and 83.9 per cent at one-quarter load, and the engine friction was relatively small.

The character of the fuel on which the engine operated during the tests is indicated in Table II, which is compiled from analysis made by a disinterested laboratory. The completeness of combustion under different loads is indicated by Table III. Table I contains data which were collected to determine the practical minimum water consumption possible and to serve as a guide in the future design of cooling towers or cooling ponds for this service.

During the test periods the three engines were required for regular service almost continuously, so that the results may be considered characteristic of modern



COOLING TOWER FOR A TEXAS DIESEL ENGINE INSTALLATION

Diesel-engine performance. It may be pointed out further that considerable care was taken to obtain representative data. The fuel oil was pumped from underground tanks to barrels located on sensitive scales (where it was accurately weighed), and thence to the individual engine supply tanks. All oil measurements were recorded in pounds and fractions thereof. Samples were taken frequently during runs for the determination of specific gravity and analysis.

The average barometer reading during the tests was 29.45 in. (varying between 29.35 and 29.52), and the average humidity was 49 per cent (varying between 41 and 58). Different degrees of pressure were tried in the first stage of the air compressor, units Nos. 1, 2 and

TABLE I—TYPICAL JACKET-COOLING WATER DATA FOR DIESEL ENGINES AT PARIS, TEX.

Unit No. 3	Pounds per Minute				Temperature (Deg. Fahr.)				B.T.U. Absorbed per Minute			
	Full	¾	½	¼	Full	¾	½	¼	Full	¾	½	¼
Engine pump intake	....	....	....	....	83	83	83	77	....	....	....	....
Air-compressor discharge	48	33	....	44	110	110	101	104	1,796	891	....	1,188
Inter-cooler discharge	None in use											
After-cooler discharge	31	33	....	36	106	120	136	110	713	1,221	....	1,188
Exhaust-header discharge	171	139	141	176	120	118	102	100	4,327	4,865	2,689	4,048
Cylinder No. 1: Jacket	52	48	42	32	138	132	131	132	2,860	2,352	2,016	1,760
Exhaust valve	11	8	9	10	102	100	96	92	209	136	117	150
Cylinder No. 2: Jacket	56	48	40	36	140	132	130	126	3,192	2,352	1,880	1,764
Exhaust valve	11	8	9	10	106	104	98	94	253	168	135	170
Cylinder No. 3: Jacket	55	48	43	34	140	132	127	126	3,135	2,352	1,892	1,666
Exhaust valve	12	8	10	11	90	104	96	92	84	168	130	165
Cylinder No. 4: Jacket	70	76	49	49	144	122	128	122	4,270	2,964	2,205	2,205
Exhaust valve	11	9	9	10	106	104	98	96	253	189	135	190
Total: Unit No. 3	528	458	352*	522	....	....	....	....	21,092	17,658	11,128*	14,494
Total: Unit No. 2	698.5	488	482	....	....	....	....	....	23,115	16,921	14,180	....
Total: Unit No. 1	647	499	485	....	....	....	....	....	22,975	18,424	13,255	....

*Except for air compressors.

TABLE II—FUEL OIL ANALYSES DURING DIESEL-ENGINE TEST*

	Specific Gravity at 60 Deg. Fahr.			Beaume (Deg.) at 60 Deg. Fahr.			B.t.u.			Sulphur (per Cent)		
Units	1	2	3	1	2	3	1	2	3	1	2	3
Quarter load	0.8463	0.8463	0.8427	35.7	35.7	35.1	19,545	19,623	19,531	0.34	0.23	0.24
Half load	0.8463	.....	0.8499	35.7	.....	35.0	19,476	.....	19,696	0.23	.....	0.22
Three-quarters load	0.8468	0.8463	0.8493	35.6	35.7	35.3	19,516	19,587	19,560	0.17	0.32	0.20
Full load	0.8463	0.8468	0.8494	35.7	35.6	35.1	19,532	19,562	19,568	0.24	0.24	0.27

*Checked by Fort Worth (Tex.) Laboratories.

TABLE III—ANALYSES OF EXHAUST GAS DURING PARIS (TEX.) DIESEL-ENGINE TESTS*

	Carbon Dioxide (per Cent)			Oxygen (per Cent)			Carbon Monoxide (per Cent)			Nitrogen, Etc. (per Cent)			Temperature (Deg. Fahr.)		
Units	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Quarter load	...	...	3.2	....	....	17.0	...	...	0.3	....	....	79.5	...	...	348
Half load	3.5	4.3	4.0	15.9	15.3	15.4	0.1	0.1	0.2	80.5	80.3	80.4	430	440	470
Three-quarters load	5.5	5.5	5.6	13.0	13.5	13.2	0.1	0.2	0.2	81.4	81.6	81.0	600	510	566
Full load	5.8	7.2	7.2	13.4	11.1	11.1	0.1	0.1	0.1	80.7	81.6	81.6	690	680	680

*Checked by Fort Worth (Tex.) Laboratories.

3 being operated at pressures ranging from 95 lb. to 120 lb. per square inch respectively on full load and corresponding pressures at lower loads. Air compressors and circulating water pumps were driven by their respective engines. Each engine was also equipped with two starting and one running high-pressure air bottle operating at approximately 800 lb. per square inch.

It should be noted that the engine unit numbers of Table III of the March 11 issue of the ELECTRICAL WORLD, which gives a summary of tests on the Paris (Tex.) engines, should be changed to read No. 3, No. 1 and No. 2, instead of No. 1, No. 2 and No. 3, to correspond with unit numbering of the tables presented herewith.

As mentioned in the preceding article on this installation, the equipment of the Paris (Tex.) station includes three 500-hp., four-cylinder, four-stroke-cycle, 164-r.p.m. Swedish-type Diesel engines manufactured by the McIntosh & Seymour Corporation. The engines are directly connected with 427-kva., 60-cycle, 2300-volt, three-phase General Electric generators.

TABLE IV—PARIS (TEXAS) DIESEL-ENGINE TESTS—DISTRIBUTION OF HEAT

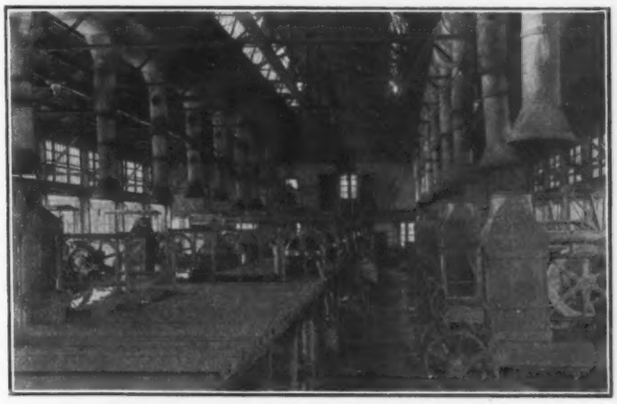
	Unit No. 1		Unit No. 2		Unit No. 3	
	M.B.t.u.	Per Cent	M.B.t.u.	Per Cent	M.B.t.u.	Per Cent
Full-load test:						
Heat converted to kw.-hr.	3,812	29	3,477	30	4,443	29
Heat absorbed by cooling water	4,560	35	4,114	35	4,830	32
Heat lost in friction, generator losses, by radiation and in burnt gases.	4,773	36	3,999	35	6,049	39
Heat *to* engine as fuel oil.	13,145	100	11,590	100	15,322	100
Three-quarters load test:						
Heat converted to kw.-hr.	2,725	29	3,082	29	3,080	29
Heat absorbed by cooling water	3,453	36	3,739	35	3,726	35
Heat lost in friction, generator losses, by radiation and in burnt gases.	3,219	35	3,805	36	3,815	36
Heat *to* engine as fuel oil.	9,397	100	10,626	100	10,621	100
Half-load test:						
Heat converted to kw.-hr.	1,415	25	1,516	25	1,947	25
Heat absorbed by cooling water	2,141	38	2,354	39	*	*
Heat lost in friction, generator losses, by radiation and in burnt gases.	2,102	37	2,194	36	.....	.....
Heat *to* engine as fuel oil.	5,658	100	6,064	100	7,789	100
Quarter-load test:						
Heat converted to kw.-hr.	165	18	191	20	346	18
Heat absorbed by cooling water	.....	.....	.....	.....	1,028	53
Heat lost in friction, generator losses, by radiation and in burnt gases.	.....	.....	.....	.....	550	29
Heat *to* engine as fuel oil.	918	100	956	100	1,924	100

*Not complete.

How Generators Used on Load Test of Gasoline Tractors Carry Part of Plant Electrical Load

At the factory of the Rumely Company, La Porte, Ind., all gasoline tractors manufactured must be tested out thoroughly before being shipped. During these tests the machines are operated under load for a considerable period of time, with the result that a large amount of energy must be dissipated. To utilize this waste energy the company has installed in the test room a number of direct-current generators mounted on a platform, as shown in the accompanying illustration, and belted to the machines under test. The tractors are first run with no load for at least two hours. A light load is then placed on the generator and the unit run for another two-hour period. After this the tractor is heavily loaded by means of the generator and run until the foreman is satisfied that it is properly doing the work required.

The small generators are all connected in parallel with



TEST ROOM OF TRACTOR MANUFACTURER SHOWING GENERATORS USED FOR LOAD TEST AND OPERATED IN PARALLEL WITH MAIN GENERATORS

the large generating units in the main power house, and the switchboard in the power house and the one in the test room are connected together through an equalizing busbar. Thus all energy which is generated as the result of the test load placed on the tractors is utilized and assists the main engines and generators in supplying energy to the entire plant. With the large number of tractors continuously passing through the test shed the energy thus generated forms a significant part of the total current used. Compared with the use of a dynamic brake as a load, the scheme also reduces the cost of conducting the load tests on the tractors chargeable to the test department.

Value of Increased Mill Production Due to Motor Drives

Recent investigations conducted in a New England worsted mill to determine the actual extent of possible benefits by the substitution of electric motors for existing mechanical drive, have shown that the increase in production would earn $5,040 per year for the manufacturer. This figure was determined on the basis of clearing 5 per cent of the selling price on the added yardage possible through electrification. The mill contains forty-eight looms which are run at a load factor of 62 per cent and a speed which varies over 11 per cent, due to the irregularities of mechanical driving. The looms operate at an average of 105 picks per minute, there being fifty-four picks per inch. On a fifty-nine-hour week this yields 119 yd. of cloth per loom.

Tests show that with the installation of group-motor drive an average of 112 picks per minute can be obtained, with a load factor of 72 per cent. The resulting output would then be 147 yd. per loom per week, or a gain of 28 yd. per loom. The selling price of the cloth is $1.50 per yard, so that the total value of the increased product is $2,016 per week for the forty-eight looms for a fifty-week year, and taking 5 per cent of the selling price as the profit, this equals $5,040. The cost of making the change, which involves the purchase of six motors aggregating 46 hp. connected load, was estimated at $1,100. On this basis the electric drive would pay for itself in less than three months.

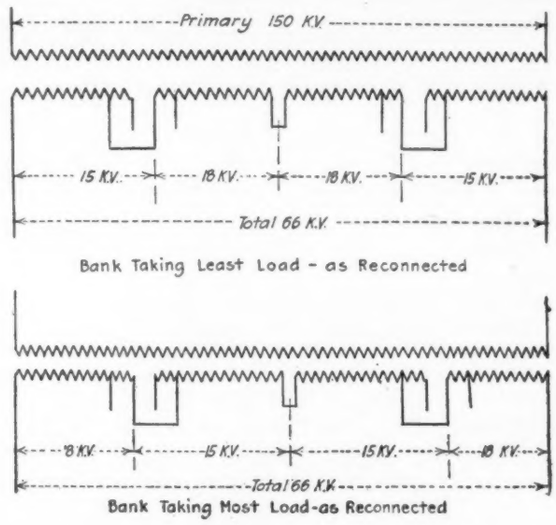
Strength of Welded Joints and Cost of Making Them

In building a 6-in. standard-weight steel-pipe steam-supply line between one of its generating stations and a large consumer, the Rochester (N. Y.) Railway & Light Company found it advisable to weld the joints with an oxy-acetylene flame. Thirty-six welds and three cuts were made to obtain the proper lengths. The cost of welding and cutting was about $3.86 per weld or cut, including labor and material. Although the first few welds were tested for mechanical strength, this was discontinued because it was considered that the rough handling to which the pipes were subjected after welding was sufficient to develop faults. It may be pointed out in this connection that sections made up of 20-ft. lengths welded together were dragged to their approximate position by placing one end on a truck and the other end on a pole "dinky." Eighty-five feet of welded pipe was suspended between supports in one case. A 10-deg. bend was also made in one welded section while cold without rupture, despite the fact that the weld was at the point of greatest stress. This experience seems to indicate that welded joints are fully as strong as the pipe itself. The pipes were equipped with extra heavy Van Stone flanges.

Transformer Connection to Balance Load of Two Banks

By H. H. Cox

In the operation of two transformer banks consisting of units of different make but of identical ratings, it was found that one bank took about 10 per cent more load than the other at full load. This operating condition while not serious was undesirable, and efforts were made to rectify it if possible. A transformer engineer



WINDINGS OF TRANSFORMERS AS RECONNECTED TO MAKE BANKS DIVIDE LOAD EQUALLY

of one of the manufacturers was called upon for a suggestion. Since his company's transformers took the most load, he suggested external reactance coils in series with the transformers. When the cost of these coils was considered it was at once found that the benefits to be derived would not justify the expense. This cost was necessarily quite high on account of the voltage of the transformers. The secondaries at that time were operating at 60 kv. The rating per bank was 13,500 kva.

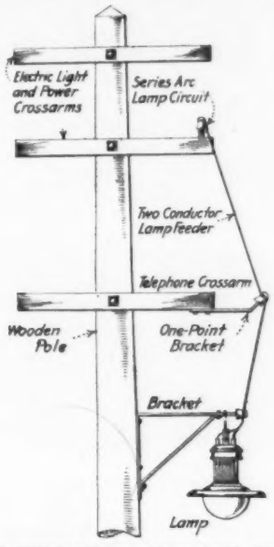
Some months later the writer had occasion to change the secondary connections of these transformers from 60 kv. to 66 kv., and the primary from 135 kv. to 150 kv. In so doing he decided to try to balance the load on the two banks by means of the coil group connections. Each secondary is made up of four entirely separate groups of coils of 18,000 volts each, with a tap at 15,000 volts. For 60 kv. all groups were connected in series, but all on the 15,000-volt tap. For 66 kv. two groups were connected on the 15,000-volt tap and two groups on the full 18,000-volt winding, thus giving the total of 66 kv.

These groups were quite widely separated on account of the large amount of insulation necessary for the 150 kv. primary. In the bank that took the most load the two end groups were connected on the full winding and the two center groups on the 15,000-volt tap. In the bank taking the least load the two end groups were connected on the tap and the two center groups on the full winding.

The result was very satisfactory, the load unbalance being reduced from 10 per cent to 3 per cent, which is hardly noticed. The explanation of the original condition is that there is less magnetic leakage in the center than on the ends, hence the full groups in the center get the benefit of more magnetic flux than those on the ends. There could be no appreciable difference in the voltage of the groups, as they must all work in parallel on 18,000-volt service.

An Arc Circuit Construction Designed with Safe Clearances

A practice in installing arc-lamp circuits in the southern suburbs of Chicago has been followed which is different from that generally employed. The conductors which supply the lamps from the series circuit are carried over the end of the telephone cross-arm instead of being taken down the side of the pole. This practice makes it possible to secure proper illumination, when it is necessary to hang the lamps at a certain fixed height above the street, and they hang below the



A METHOD OF SUPPORTING ARC LAMP AND ITS FEEDER

telephone arm. Also with the lamps in this position it is possible to secure safe clearance, both between the telephone and arc circuits and between arc circuits and linemen when they are working on the poles. The clearance afforded by this construction is about 2 ft.

In carrying out this type of construction the series arc circuit is opened near the cross-arm at an insulator, and a two-conductor rubber-covered lamp feeder is dropped from the end pin of the electric service company's cross-arm to the lamp. At the point where it passes the telephone company's cross-arm it is tied to an insulator on a one-point bracket fastened to the under side of the telephone arm. The lamp itself is insulated from the iron bracket on which it hangs and another insulator is used to prevent the bracket from becoming energized from the wires of the loop. The lamps are trimmed without being lowered.

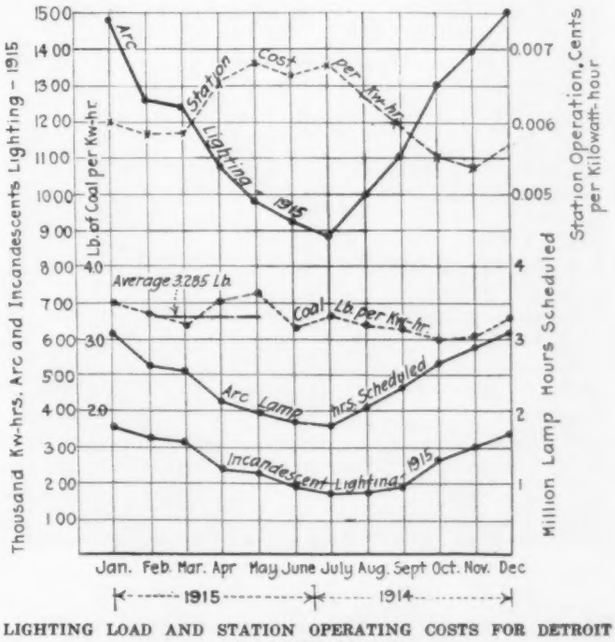
Cost of Operating City Lighting Plant in Detroit

The energy for the municipal lighting system in the city of Detroit is generated at a steam station which contains one 5000-kw. and two 2000-kw., 60-cycle, 2300-volt, two-phase Westinghouse turbo-generators with steam-driven auxiliaries. A triple expansion 800-hp. Williams steam engine also operates a 600-kw., two-phase, 2300-volt Stanley alternator. The boiler plant contains four 300-hp. double-deck tubular boilers with Hawley down-draft furnaces, one 300-hp. Wickes vertical water-tube boiler with Detroit stoker, three 400-hp. Wickes vertical water-tube boilers with Taylor stokers and Foster superheaters, and two Sterling water-tube boilers with Taylor stokers. The coal used is Meadowbrook lump at $2.50 per ton, and nut, pea and slack at $2.25 per ton.

TABLE I—COST OF OPERATING PLANT FOR YEAR ENDED JUNE 30, 1915

	Total	Cost per Kw-hr-cent
Maintenance:		
Buildings, track, dock, etc.	$2,397.82	
Steam plant	7,541.22	
Electric plant	3,860.33	
Miscellaneous tools and machinery	4,131.05	
Conduits	1,196.30	
Towers and lamp posts	1,787.06	
Arc lamps and switches	6,868.32	
Lines and cables	29,138.08	
	$56,920.18	0.00329
Executive:		
Salary secretary and city electrician	$8,000.00	
Printing and stationery	848.88	
Store room	4,395.73	
Office expense	8,695.28	
Superintendence and drafting	6,881.33	
	$28,821.22	0.00166
Station:		
Oils	$481.28	0.00003
Waste	30.97	0.00000
Coal	64,375.32	0.00372
Miscellaneous supplies	1,433.08	0.00008
Wages	38,523.88	0.00222
	$104,844.53	0.00605
Lighting:		
Trimming and patrolling	$19,063.10	
Electrodes	8,618.15	
Rectifier tubes	1,721.00	
Incandescent lamp renewals	4,801.61	
Incandescent lighting expense	1,225.72	
Globes	2,471.47	
Miscellaneous supplies	49.75	
Belle Isle Park	933.85	
Palmer Park	79.20	
	$38,963.85	0.00225
Shop supplies	$40.65	
Surgeon and hospital	2,130.10	
Relief fund	4,115.61	
Total operating cost	$235,836.14	0.01361
Total kilowatt-hour output at switchboard, 17,327,785		

The city's lighting system load consists of 8193 4-amp. and 6.6-amp. series arc lamps for street lighting, and 1210 kw. of carbon incandescent lamps, 4350 kw. of tungsten incandescent lamps and 1840 hp. in small motors and fans in public buildings. To the main station 2554 arc lamps are connected, with the remainder connected to the distribution circuits from five substations. The total operating expenses for the system, according to the twentieth annual report of the Public Lighting Commission, just published, is given in the accompanying table. The kilowatt-hour load represented by the arc and incandescent lamps, the total lamp-hours scheduled, the station operating costs and the coal burned per kilowatt-hour for the twelve months covered by the report, are shown in the accompanying curves.


Thousand Kw-hrs. Arc and Incandescents Lighting - 1915
Lb. of Coal per Kw-hr
Million Lamp Hours Scheduled
Station Operation, Cents per Kilowatt-hour
Arc Lamp hrs. Scheduled
Incandescent Lighting 1915
Station Cost per Kw-hr.
Lighting 1915
Average 3.285 Lb.
Coal Lb. per Kw-hr.
Jan. Feb. Mar. Apr May June July Aug. Sept Oct. Nov. Dec
1915
1914

LIGHTING LOAD AND STATION OPERATING COSTS FOR DETROIT CITY LIGHT PLANT

MARKETING ELECTRICITY

A Department on Selling Service and Widening the Use of Electrical Energy

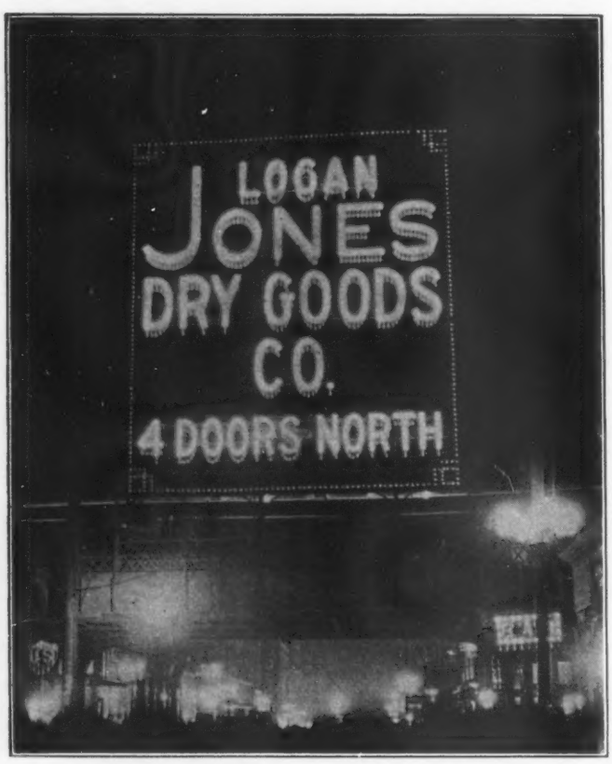
Reclaiming a Business District with Electric Signs

How Retail Trade Has Been Drawn Back to the North Side of Kansas City, Mo., by the Aid of Illuminated Legends and the "Bright Lights" of the Merchants' Displays

The North Side of Kansas City, Mo., where fifty years ago the city was established, is now coming back into its own. In the war days, "Kansas City" was on the water front of the Missouri River. As recently as twenty-five years ago the chief retail section of the town was north of Ninth Street, and ten years ago it was north of Twelfth, but latterly, the tendency of business has been to move farther and farther south. The North End, once a boast, became a reproach about the beginning of the present century, and for several years it looked as if there might never again be good business north of Ninth Street.

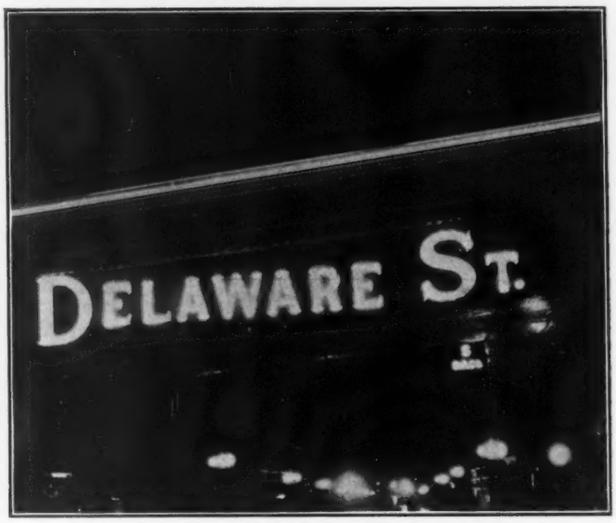
A few months ago, however, a well-known Kansas City merchant, one of two brothers who had built a great retail trade with a department store in the downtown section, established a new department store between Seventh and Eighth Streets, the store extending through the block, with fronts on Main and Delaware Streets. Since then other first-class retail establishments have located there, and the district is looking up.

The Eight Street viaduct of the street railway spans Main Street and Delaware at Eighth Street, and has seemed to mark a sort of dividing line for the better class of trade on these streets. People looking northward from the present retail section saw this viaduct staring them in the face—it blocked the view as well as the imagination.



THE DEPARTMENT STORE'S "LANDMARK" SIGN

This department-store sign, visible for blocks down the street, attracts attention to the bright lights of the newly reclaimed shopping district beyond it



A STREET SIGN THAT CAN BE READ A MILE AWAY

This railroad viaduct, which bounded the older shopping district, now serves as the support for the big electric sign that draws trade to the region which the structure formerly cut off from business activity

One of the first things the new department-store owners did, therefore, was to erect a great electric sign on the side of this viaduct, facing the south part of the business district, and visible throughout the length of Main Street north of Twelfth. This sign, which is pictured on this page, measures 35 ft. by 35 ft., and is surrounded by an illuminated border which contains 360 5-watt lamps. When the sign is in operation, with its legend being flashed on and off alternately, no observer can face north on Main Street downtown, north of Eighth, without having his eye assailed by this sign. The display has drawn attention to the North End most favorably, for people also see that there are many lights north of the viaduct, and as a result the general public is again fixing this district in its mind as part of the retail section.

While North Main Street has always been a busy retail thoroughfare, and probably always will be, the class of business thereon has been deteriorating, the bulk of stores being saloons, second-hand stores and similar establishments. Delaware Street, one block west, which comes to a junction with Main Street in its southward way and there ceases to be, has long since ceased to be a retail street at all—indeed, it already has many large vacant buildings. In part it has been turned over to wholesalers and small manufacturers, and as a business street it has been going to ruin. Property owners on this street as well as in other parts of the North End have for years vainly striven to devise a means of bringing the street to life. But when Mr. Jones opened his store, with a frontage on Delaware Street, they took heart. Getting together, they bought

an electric sign to place on the Delaware section of the Eighth Street viaduct. This sign, as shown herewith, has initials 8 ft. high, and the other letters measure 5 ft. in height. The sign has 150 10-watt lamps. The effect of the display has been to make people think of Delaware Street, as a real part of the modern Kansas City.

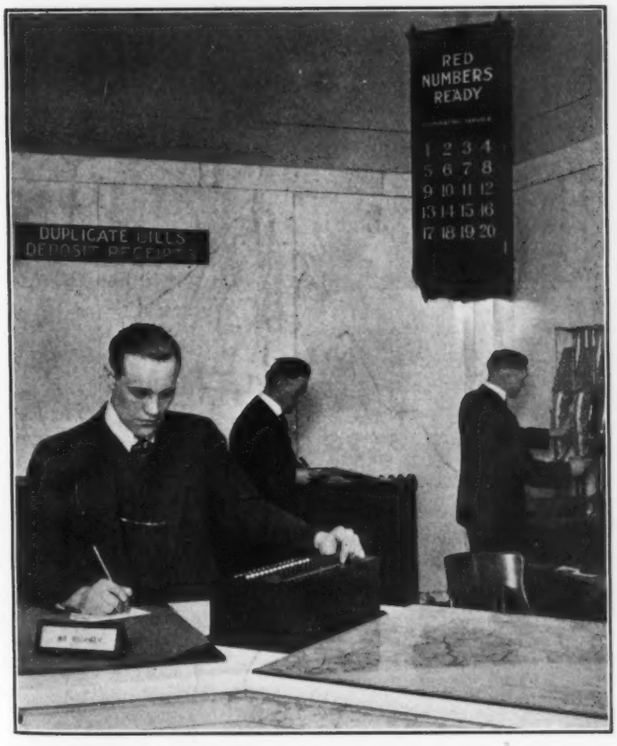
And so these electric signs are pointing the way to the returning tide of business in this section. They suggest, moreover, a means available almost anywhere for the reclamation of business property that has been "slipping," or the enhancement of new business sections to even greater trade and prosperity.

An Annunciator to Serve Customers Waiting for Duplicate Bills

The Cleveland Electric Illuminating Company has just installed an electric annunciator in its large general salesroom and cashiers' office on the street floor of its building. This annunciator gives prompt service to customers who are waiting for duplicate bills to be made out, or those who have called to make other inquiries regarding their accounts.

In a prominent place on the office wall has been mounted a large cabinet indicator containing numbers from 1 to 20. When a customer calls to make payment on his account, but has neglected to bring with him the statement previously mailed out by the office, he is asked to wait while the accounting department makes out a duplicate. A number is assigned him and he is requested to make himself comfortable in the office lobby until this number appears on the annunciator box, indicating that the duplicate statement is ready for him. A pneumatic tube leads from the office desk to the accounting division, and through this the request for the duplicate is transmitted and the desired statement quickly returned.

On the counter at convenient points are placed three indicator switchboxes, wired in multiple. Each counter box contains twenty small switches corresponding to the numbers on the annunciator, and each switch is provided with a red and a white lamp. When a wire is not in use the corresponding white lamp shows at each switch, but when the line is "busy" the red light appears, so that the clerks may know which numbers are already in use.



A NUMBER LIGHTED RED SUMMONS THE WAITING CUSTOMER WHEN HIS DUPLICATE BILL IS READY

CALL SIGNAL OPERATED FROM ACCOUNTING ROOM

A small indicator in the accounting department, connected with the apparatus below, is numbered the same as the large one in the salesroom, and when a switch is thrown the number there appears red. When the bill is ready to send down, the clerk pushes a button, which causes the proper number on the indicator below to show red. At the same time the buzzer operates, calling the attention of customers to the fact that a figure is lighted. The customer whose number has appeared then walks to the counter and receives his bill or information without having his name called out, as was formerly necessary. Because of many difficult foreign names encountered in Cleveland, it was often impossible to call them correctly. The annunciator, of course, avoids all such embarrassment.

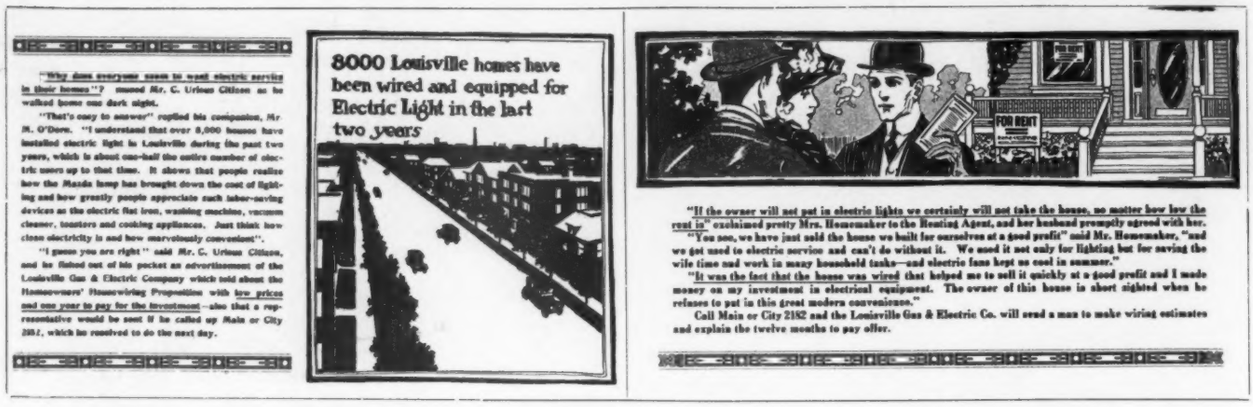
The time is stamped on the request blank when this is sent to the accounting department and again when it is handed to the bookkeeper. In order to insure accuracy, the forms are also filled out in duplicate, so that there may be a check at every point. It is thus always possible to tell just how much time has been required in making out a bill or in answering an inquiry, and to learn whether the service has been prompt or not. In this way the Cleveland company is following its own slogan of "Service."

The Electric-Range Selling Price Should Include Cost of Installation

The desirability of including in the selling price of the electric range an allowance for the cost of installing the equipment in the purchaser's kitchen free of further expense to him, was emphasized by P. L. Miles in a talk on electric-cooking campaign methods before the Indiana central station commercial men's conference last week.

"The installation charge—that is, the cost of running the wires from the meter to the range—at first seemed to be quite a bugaboo to the selling of ranges," said Mr. Miles. "Many central stations made an installation charge of $5 to $10—or the actual cost of the work, based on time plus material. This, however, really necessitated the salesman making two sales instead of one. For it was discouraging for the salesman, after getting the prospect up to the closing point—and it probably had been up-hill work—to have to say—'Now, Mrs. Williams, there is a charge of $10 for running the inside wires to connect your range.' Mrs. Williams may have had to strain a point to meet the cost of the range itself, and this additional burden often proved too much.

"This whole question of the installation charge," continued Mr. Miles, "should be one of commercial expediency, rather than of equity. That the customer should pay for this inside wiring—which after installation becomes his property—admits of no argument. But the average housewife's answer will invariably be—'I don't see why I should pay for the range and then have to pay to have it installed.' It appears then," said the speaker in conclusion, "that the best course to pursue is to include the cost of installation in that of the range, the total to constitute the list price. In this manner, only one sale is necessary, and the price quoted covers the cost of the stove, delivered, installed, and ready to snap on the current."


"Why does everyone seem to want electric service in their homes"? mused Mr. C. Urious Citizen as he walked home one dark night.
"That's easy to answer" replied his companion, Mr. H. O'Dore. "I understand that over 3,000 homes have installed electric light in Louisville during the past two years, which is about one-half the entire number of electric users up to that time. It shows that people realize how the Mazda lamp has brought down the cost of lighting and how greatly people appreciate such labor-saving devices as the electric flat iron, washing machine, vacuum cleaner, toasters and cooking appliances. Just think how clean electricity is and how marvelously convenient".
"I guess you are right" said Mr. C. Urious Citizen, and he fished out of his pocket an advertisement of the Louisville Gas & Electric Company which told about the Homeowners' Housewiring Proposition with low prices and one year to pay for the investment—also that a representative would be sent if he called up Main or City 2182, which he resolved to do the next day.
8000 Louisville homes have been wired and equipped for Electric Light in the last two years
FOR RENT
"If the owner will not put in electric lights we certainly will not take the house, no matter how low the rent is" exclaimed pretty Mrs. Homemaker to the Heating Agent, and her husband promptly agreed with her.
"You see, we have just sold the house we built for ourselves at a good profit" said Mr. Homemaker, "and we got used to electric service and can't do without it. We need it not only for lighting but for saving the wife time and work in many household tasks—and electric fans kept us cool in summer."
"It was the fact that the house was wired that helped me to sell it quickly at a good profit and I made money on my investment in electrical equipment. The owner of this house is short sighted when he refuses to put in this great modern convenience."
Call Main or City 2182 and the Louisville Gas & Electric Co. will send a man to make wiring estimates and explain the twelve months to pay offer.

TWO OF THE POST CARDS, IN COLORS, MAILED TO HOUSE-WIRING "PROSPECTS" BY THE LOUISVILLE COMPANY

A "High Spot" in a Continuous House-Wiring Campaign

How the Louisville (Ky.) Gas & Electric Company is Stimulating Interest in Electric Service Among Owners and Tenants of Already-Built Houses

The firm belief of H. M. Byllesby & Company of Chicago in consistent and persistent advertising is exemplified in a campaign which is being conducted at one of its properties, the Louisville (Ky.) Gas & Electric Company. Throughout the last few years a continuous and determined effort has been made at Louisville to introduce electric service into already-built houses. Newspaper advertising and some direct-by-mail advertising has been used to draw inquiries which could be followed up by salesmen. The 3000 old houses wired last year stand as silent evidence of the results produced.

Still there remain, however, about 8000 or 9000 residences which are taking gas service from the Louisville company but which do not use electric light. These unwired residences are on the company's existing electric service lines and could be connected with but comparatively slight expense if the owners could only be made to want electric service. The fact that gas is already being used proves that electricity is not beyond the financial means of the occupants. They are real "prospects." Then, too, the company has a "live prospect" file of perhaps 600 names, made up from the reports of salesmen who as yet have not secured the business they have sighted.

CARDS AND LETTERS BOTH CONSIDERED—CARDS CHOSEN

This, then, in a nutshell, was the new-business problem as it existed prior to the card campaign. The list of excellent prospects was already available and it was merely a question of how best to reach them.

Robert Montgomery, commercial manager of the Louisville company, after the advisability of using letters under 2-cent stamps had been carefully considered, suggested that a series of six 1-cent postcards might be effectively used at monthly intervals. The suggestion was thought appropriate, and after some consideration had been given to it, a decision to use attractive and interesting postcards was reached. The time interval between mailing dates was fixed, however, at two weeks instead of four.

Accordingly, copy for the cards and instructions for the artist were written by the publicity department of H. M. Byllesby & Company. Both the copy and the instructions were sent to the artist so that he might more fully grasp the idea to be conveyed by each card and by the series as a whole. With the copy and art work finished in Chicago and the final printing done in Louisville the cards were made ready for mailing.

The "snappy" conversational copy and its background of appealing two-color art work have been designed solely to interest people and to stimulate a desire for electric service. No attempt has been made to explain the company's low-priced wiring propositions. That work is left to the coincident daily newspaper advertising and to the company's salesmen.

The newspaper advertisements carry two special inducements—a panel-board installation for $2.99 and complete wiring for a four-room home for $20.40. It is expected that the profitable experience of the past will be repeated in connection with the liberal panel-board offer. That is to say, many will inquire for the panel-board installation, but all except a few will be induced by the company's efficient salesmen to buy complete wiring.

This high spot of the company's continuous house-wiring campaign is just now well under way. What tangible results it will produce remains to be seen. What it cost, however, can be told now. The expense has been exactly 1¾ cents per card. In other words, the company is spending only 10.62 cents on each prospective customer.

These figures are based on the fact that 48,000 cards will be mailed in the twelve weeks campaign. The artist's work cost $90. The making of the plates cost $63.15. The printing amounted to $218.50 and the mailing at 1 cent per card cost $480. The total cost of the 48,000 cards delivered was, therefore, $851.65 exclusive of a small item for labor for operating an addressograph. On the whole the effort is considered an inexpensive one.

Profitable Echoes of a Traveling-Truck Demonstration Tour

During the months of last summer the Washington Water Power Company twice sent an appliance-laden automobile truck over its system in the vicinity of Spokane to demonstrate electric ranges and appliances to the public. An account of this unique campaign plan appeared on page 28 of the ELECTRICAL WORLD of July 3, 1915, together with pictures of the equipment.

The results from the season's work, however, still continue to appear, and it is of particular interest to note that the sales manager of the company, M. C. Osborn, attributes 25 per cent of the new business acquired by the company since the campaign to "prospects" which the truck demonstrations developed.

The cost of the two expeditions, each of which covered the thirty-four towns served by the company, totaled about $3,700. Of this sum about $1,000 came back in net profits on appliance sales actually made during the trips. These sales added 200 kw. to the company's regu-

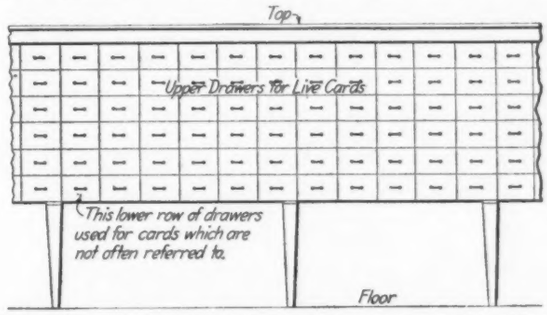
lar load, and contributed $600 per year in revenue.

By far the greatest benefits, however, come from the interest drawn to the electric range. During the winter months that have elapsed since the demonstration, ten ranges have been sold to customers whose inquiries are known to have come in as a result of the travels of the motor truck.

The photograph showing a crowd standing about this demonstration truck, reproduced on page 925 of last week's issue, was taken at 10 o'clock at night in a town whose population was only 1200, and indicates how much interest was shown in the demonstrations. Usually two demonstrations were given daily, and each "show" was witnessed by as many people as could crowd up to within hearing distance.

Filing Case Arrangement Saves Stooping

In the application bureau of the Commonwealth Edison Company at Chicago all dead cards carrying data on former customers' installations are filed in the lower row of drawers. These cards are the ones to which



THE LOWER DRAWERS ARE RESERVED FOR CARDS CARRYING DATA ON FORMER CUSTOMERS' INSTALLATIONS

the application clerks refer least frequently. The advantages of this scheme, as pointed out by Harold Wright, chief clerk of the contract department, are that the operators are not required to stoop to the lowest level of drawers as frequently as they would have to if the entire file contained live cards and dead cards were in a separate file. Furthermore, the necessity of lifting the bottom drawer to a level at which it may be worked on is of rare occurrence.

Hints on Soldering

Several useful suggestions on the subject of soldering electrical conductors were offered by H. G. Young, city electrician of Streator, Ill., in a talk on electrical wiring methods given before the local section of the N. E. L. A.

The most careful attention should be given to the subject of soldering all joints, said the speaker emphatically. It is not sufficient merely to daub a little solder on the outside of the twists of the wires. Instead, the solder should be thoroughly sweated in and the joint then covered with rubber and friction tape. A joint not properly soldered is likely to corrode, offer high resistance, or become loose enough to start an arc and perhaps cause serious trouble. Mr. Young recommended the use of the soldering iron for making the best job, since this does not heat up and sometimes destroy the insulation for a distance on each side of the joint, as may happen with a torch. For outlet-box joints a small dip pot is preferable. It saves time, does not drop solder on furniture or floors, and is faster. Acid should never be used in electrical work, as it is likely to eat and corrode the wires. A good paste or resin-core solder should be employed.

Merchandising Electrical Appliances at a Profit

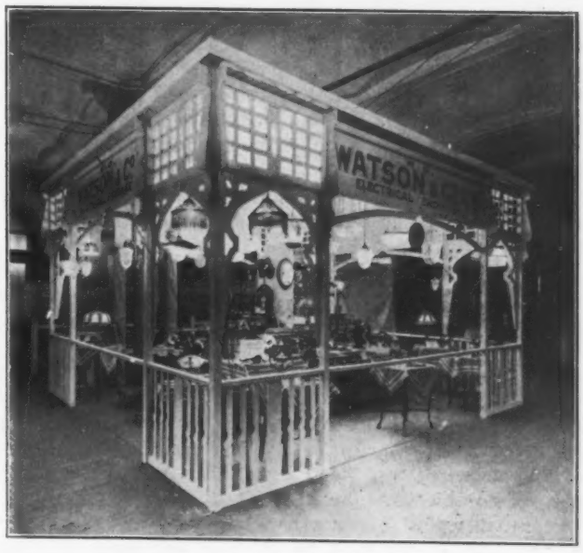
A central-station company in the West which annually merchandises appliances worth about $75,000, reports that these sales have netted $2.04 per annum per consumer on appliance sales. This is exclusive of the house wiring which the company's own forces do in small towns, and it does not take account of general appliance advertising expense, which it is not considered fair to charge entirely against sales which have thus far been made.

An Electric-Heating Installation that Paid Handsomely on the Investment

The average cost of "repairing" patent-leather shoes going through a Massachusetts shoe factory formerly averaged 2½ cents per pair on the entire production of the plant—an estimate based on a year's figures, including both busy and dull seasons. After considerable experimenting to reduce this item of expense, a number of electrically heated turners' irons were installed, and now these, after a number of months' actual use, have reduced the cost of repairing the patent-leather shoes to 1⅛ cents per pair. As the factory makes on the average 1000 pairs of shoes per day, a saving of $13.75 per day has been effected, or a saving of $3,437.50 in a working year of 250 working days.

An Electric-Appliance Exhibit Booth in Far-Away Australia

Concrete evidence of the wide-awake interest in electrical household conveniences which is manifested by the public of Sydney, Australia, was the booth of W. G. Watson & Company, dealers in electrical appliances, exhibited at a recent local household show held in the capital city of New South Wales. The exhibit, as pictured, included a number of American-made heating appliances for which the Watson company is the Australian distributer, and shows how widely the modern ideas of electrical merchandising have spread. It is an object lesson to many dealers in America.



AN AUSTRALIAN ELECTRICAL DEALER'S EXHIBIT AT A SYDNEY (N. S W.) HOUSEHOLD SHOW, FEATURING HEATING APPLIANCES MADE IN THE U. S. A.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Electric Power Supply in Switzerland

The Evolution of the Government-Ownership Idea—The Beznau Loentsch Works, Acquired by a Combination of Cantons, Generate 130,000,000 Kw.-hr. per Year

IN *Elektrische Kraftbetriebe und Bahnen* of March 4, 1916, G. Soberski gives an interesting historical sketch of electric power supply in Switzerland and the growth of the government-ownership idea. While this subject is of considerable interest to American readers, it must be emphasized at the outset that it would be quite erroneous to draw conclusions from Switzerland's experience as to what might be advisable as a policy elsewhere. The conditions of Switzerland and the United States are very different, for Switzerland is a densely populated country, very rich in water-powers all concentrated within a comparatively small area. Moreover Switzerland is poor in fuel. The development of water-powers therefore became an industrial necessity at an early date. At the start of this development all hydroelectric plants in Switzerland were privately owned. The Canton Freiburg was the first to try the experiment of government ownership by building with its own money the Hauterive 10,000-hp. power plant which as early as 1906 supplied 168 towns (containing 94,000 inhabitants) with light and power; four years after its inauguration it is said to have become an interest-paying proposition. In the Canton Waadt the canton authorities combined with the municipalities in developing an 8000-hp. water-power at the Joux Lake, which was enlarged in 1908 to 16,000 hp. by the erection of a power plant in Montcherand. The Canton Bern has participated in developing water-powers in its area by buying stock in the companies developing these water-powers, and other cantons have done likewise.

On the other hand, in the Canton Aargau the government-ownership idea could not make much headway because there existed successfully operated privately-owned power plants; and other cantons in eastern Switzerland found similar difficulties on account of existing private plants so that these cantons had to be satisfied with acquiring the local distribution stations and buying partly or wholly their power from private generating plants. Only the Cantons of Zurich and Schaffhausen could undertake the erection of a large plant near Elisau on the Rhine to generate most of the power needed in the district.

The largest private power plant of eastern Switzerland was the Beznau-Loentsch works, consisting of the Beznau plant generating 70,000,000 kw.-hr. per year, and the Loentsch plant, generating 60,000,000 kw.-hr. per year. Both plants generate three-phase currents at 8000 volts, which are raised to 25,000 or 40,000 volts for transmission to ten substations, where the voltage is reduced to 8000. In 1912 the length of the high-tension net work was 3190 km. (1914 miles), and the length of the low-tension network 190 km. (114 miles). The company paid 4 per cent dividends in 1908, 5 per cent in 1909, 6 per cent in 1910, 7 per cent in 1911 and in 1912, and 7½ per cent in 1913. In 1914 the cantons of Aargau, Glarus, Zurich, St. Gallen, Thurgau, Schaffhausen, Schwyz, Appenzell and Zug bought these works, paying $138 per share of $100 par value. Some thought this was a pretty good price, but it is expected that the joint operation of the Beznau, Loentsch and Eglisau plants will give satisfactory financial results, on the basis of an average selling price of 0.64 cent per kilowatt-hour. This combination of plants will be owned by a stock company, the stock being owned by the different cantons (Zurich 38 per cent, Aargau, 29 per cent, Thurgau 12 per cent, etc.). The author thinks Germany should proceed along similar lines and that the experience of Switzerland shows that to get best results a greater number of states or cantons must combine.

Generators, Motors and Transformers

Magnetos for Electric Ignition.—H. ARMAGNAT.—An illustrated article giving first a historical sketch of the development of the magneto for electric ignition for gas engines. The author then considers the design of the magneto and gives a general theory underlying its action. This is developed in detail, equations being given embodying the theory and illustrated graphically.—From *Le Revue Elec.*, translated in London *Electrician*, March 24 and 31, 1916.

Lamps and Lighting

Rating of Incandescent Lamps by Watts.—RUD. NAUJOKS.—An article discussing the present practice of German lamp factories of designating their incandescent lamps by watts only without stating the candle-power. He emphasizes that this is misleading and confusing because lamps designated by the same number

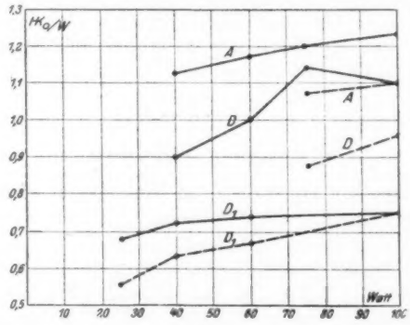


FIG. 1—CANDLE-POWER VARIATION IN WATTS CONSUMED UP TO 100 WATTS

of watts may have very different candle-powers. The consumer, therefore, is entirely left in the dark as to what he buys. Lamps were bought from four different German firms, called "A," "B," "C" and "D," and a table in the article shows that for the same number of watts consumed the candle-powers may vary considerably between products of different companies. For two different companies "A" and "D" these results are plotted in Fig. 1, in which the abscissas represent watts and the ordinates candles per watt. The drawn-out curves refer to 130-volt lamps and the dotted curves to 250-volt lamps. The curves marked D_1 relate to lamps sold as "spiral lamps." Fig. 1 gives the data for lamps above 100 watts. The drawn-out curves again

refer to 130-volt lamps and the dotted curves to 250-volt lamps and it will be seen again that the lamps of the factory "D" are much inferior to the lamps of the factory "A." The author thinks it is absolutely necessary that besides the watts the candle-power should also be stated on the lamp.—*Elek. Zeit.*, March 30, 1916.

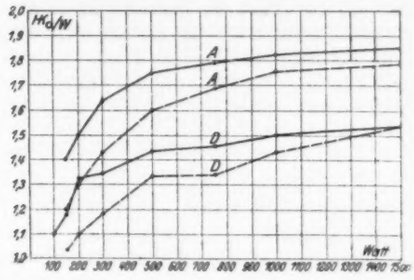


FIG. 2—CANDLE-POWER VARIATION IN WATTS CONSUMED ABOVE 100 WATTS.

Portable Electric Lamps.—HIRAM H. HIRSCH.—An abstract of a paper read before the North of England Institute of Mining and Mechanical Engineers. The author describes two portable lamps, the first being a hand lamp for watchmen and the other a miner's cap lamp. The former consists of a storage battery placed on an asbestos cushion in a cast-aluminum casing provided with a hinged top. The reflection unit is made up of concentric safety shells, an incandescent lamp, a safety glass, a crystal and a switch. The miner's cap lamp is supplied from a storage battery fitted in a cast-aluminum box, and carried in the miner's belt. In the battery a gelatinous solidified electrolyte is used.—London *Electrician*, March 24, 1916.

Generation, Transmission and Distribution

Electric Power in South African Mines.—A brief note on a paper by J. Norman Bulkley on the application of electric power to mining work in the Witwatersrand area in South Africa. It is stated that the total steam turbine capacity installed in the Brakpan, Simmer Pan, Rosherville and Vereeniging stations is 204,200 kw. These are supplied by the Victoria Falls & Transvaal Power Company, and its subsidiary the Rand Mines Power Supply Company. The Randfontein, East Rand Proprietary and Kleinfontein Group all supply their own power, amounting to about 52,000 kw. With regard to pumping, fortunately most of the Witwatersrand mines are comparatively dry, 10,000 gal. per hour units in duplicate generally being sufficient to handle all the water. The East Rand Proprietary Mines, however, require pumps of 60,000 gal. per hour capacity. Most of the pumps are electrically driven, and the motor drives generally through belting to the pump, as it is found this lowers the maintenance costs. Stepdown transformers are used where the voltage is high, the high-tension cables being taken down the shaft. Owing to the lower prime costs, several centrifugal pumping plants working on high heads have been installed, one at the Durban Roodepoort Deep Gold Mining Company having a head of 2490 ft., and each pump being fitted with a 550-hp. motor.—London *Electrician*, March 31, 1916.

Transmission Gear.—A description of a 30-ton traverser fitted with the Hele-Shaw transmission gear. This gear consists of an oil pump driven by a 50-hp., three-phase, 25-cycle induction motor, and three oil motors driven by the oil pump. Two of these oil motors are required for the traverser and one for operating the capstan head by means of which wagons are hauled on or off the traversing carriages. The oil motors are governed by regulating the pump capacity; change-over valves, non-return valves and safety valves being also provided. An electrically operated emergency brake is fitted to each axle shaft and is operated by means of a switch interlocked with the controller, so that the brakes cannot be applied unless the controller handle is in the "off" position. Current is applied to the motor from overhead wires, through trolley collectors mounted on a tower at one end of the locomotive. The traverser was specified to be capable of an average speed in either direction of 300 ft. per minute measured over a length of track of 220 ft. when propelling or hauling one of the traversing carriages carrying a loaded wagon weighing 30 tons. The acceleration when starting under such conditions is 0.5 ft. per second, so that a maximum speed of 440 ft. per minute is reached in fifteen seconds. Under normal conditions the capstan head is capable of exerting a rope pull of 750 lb. at a speed of 300 ft. per minute, and this figure can be increased at 2000 lb. The traverser has to serve any one of eight sidings, and fearing that with any form of three-phase motor drive much time would be lost, R. T. Smith, the electrical engineer of the Great Western Railway Company, decided to adopt the Hele-Shaw hydraulic transmission gear for communicating the drive from the motor to the wheels. This arrangement has proved most successful, and the ease with which the traverser can be accelerated or retarded, speeded up or reversed is said to be remarkable.—From London *Engineering* abstracted in London *Electrician*, March 17, 1916.

Wires, Wiring and Conduits

Low-Tension Fuses.—JOHN A. CRABTREE.—An article on the renaissance of the low-tension fuse. In the last six years there has been a remarkable improvement in fuses and fuse boards. In the writer's opinion, this improvement is not merely due to the ordinary processes of evolution, but rather to the compelling forces of the (British) Home Office regulations governing the use of electricity in factories. The author discusses the shielding of live parts, hot handles, and the desirability of standardizing fuse breaks. Fig. 3 gives a diagram showing 500-volt fuse breaks by several of the leading

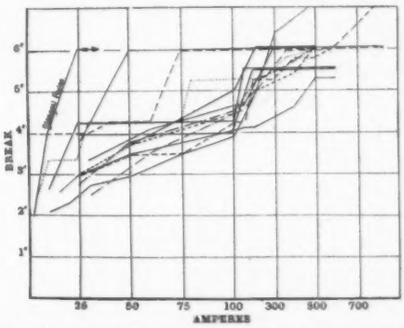


FIG. 3—DIAGRAM OF 500-VOLT FUSE BREAKS

British manufacturers. It will be seen that there is a considerable variation in the lower capacity fuses, and the various makes only draw into reasonable harmony toward a 6-in. break for 500 amp. Soaring well above the majority are the Glasgow specifications for fuse breaks. It seems hard to realize that all these varying sizes are seriously put forward by manufacturers to perform exactly the same function. It should be possible to establish some suitable standard, leaving each manufacturer to work out his own details. The circuit-opening efficiency could and should be covered by a definite clause as to the conditions under which each size of fuse should effectively blow. The article is to be concluded.—London *Elec. Rev.*, March 10, 1916.

Suspension Insulators.—W. PETERSEN.—An account of tests of the distribution of tension over the different

portions of a suspension insulator, for a series of types of such insulators.—*Elek. Zeit.*, Jan. 6 and 13, 1916.

Electrophysics and Magnetism

Natural Charges of Metals.—FERNANDO SANFORD.—A paper read before the American Association for the Advancement of Science and the American Physical Society. Metals, and probably all other bodies, when in electrical contact with the earth still retain characteristic charges which are capable of inducing electric separations in other bodies brought near them. When two metals are brought near together, their induced free charges will escape to the earth or to any other conductor with which they may be in metallic contact. Their bound charges remain in or on the metal. If after their free charges have escaped the metals be insulated and then separated, the bound charges become free, and are the so-called contact charges of Bennett and Cavallo. The magnitude of the natural charge of a metal seems to be determined by its internal cohesion, and hence presumably by its specific inductive capacity. Whatever changes there are, the specific inductive capacity of the metal, or even of its surface, will accordingly produce a change in the fixed charge of the metal. This point of view consists merely in introducing the earth into the contact series. It seems certain that the same metal will hold different charges when in contact with different parts of the earth, as it will when in contact with the interiors of different hollow conductors.—*Science*, March 24, 1916.

Electrochemistry and Batteries

Dry Cells.—W. R. COOPER.—An account of recent investigations of dry cells and the materials used in them. The carbon is surrounded by a paste made of manganese peroxide and carbon, with some graphite to decrease the internal resistance, and electrolytic constituents and water. An average mixture is made by taking—

Manganese peroxide	10 lb.
Carbon or graphite, or both	10 lb.
Sal ammoniac	2 lb.
Zinc chloride	1 lb.

Sufficient water is added to this mixture to make it into a suitable paste. A formula given by H. K. Richardson as being commonly used in the United States is as follows, expressed in parts, presumably by weight:

Manganese, peroxide (85 per cent, MnO_2)	100
Ground coke	80
Artificial graphite	20
Sal ammoniac	20
Zinc chloride (30 deg. B.)	7

Between the depolarizing paste and the zinc is what may be called the "electrolytic paste." It is generally white, and is made up of flour, plaster of Paris, sal ammoniac and zinc chloride, with enough water to form a paste. Sometimes a transparent gelatinous paste is used. In American practice the electrolytic paste is cut down so far as to consist merely of a few layers of pulp board or blotting paper moistened with electrolyte. An account is given of an investigation by J. G. Lucas of the fact that escaping gases carry moisture with them so that the cell dries up and the internal resistance increases and sets a limit to the life of the cell. Several types of desiccated cells made by British companies are described and illustrated.—London *Electrician*, March 31, 1916.

Fixation of Atmospheric Nitrogen.—F. S. WASHBURN.—Long extracts from a pamphlet issued by F. S. Washburn for private circulation on "The Facts in the Nitrogen Gas Now Before Congress." There is a comparison of the production of nitric acid by direct combustion of atmospheric air by means of the electric arc with the production of calcium cyanide from calcium carbide and nitrogen and subsequent transformations of the cyanamid into ammonia and into nitric acid.—*Met. & Chem. Eng'ing*, April 15, 1916.

Units, Measurements and Instruments

Mutual and Self-Inductance Formulæ.—S. BUTTERWORTH.—Numerous series formulæ have been obtained for the mutual induction between coaxial circles. In general, these formulas have been completely determined (*i.e.*, the range of convergency and general term are known) only in the case of circles far apart. In the present paper a method is developed which yields the general term for formulas which hold when the circles are close together. The formula for the self-induction of a solenoid is also given.—*Philos. Mag.*, April, 1916.

Telegraphy, Telephony and Signals

Single-Phase Traction and Telegraphy.—DEVAUX-CHARBONNEL.—The first parts of an article on the disturbing effects produced by single-phase traction lines on telegraph systems in the neighborhood and on the protective devices which have been proposed to overcome these induction effects. The simplest protective devices are the impedance apparatus, while Marius Latour and Griousse have proposed resonance devices; the former are effective only for inductions of about 100 volts, the latter are more efficient and can be employed up to 500 volts and even above that.—*La Lumière Elec.*, March 11, 1916.

Miscellaneous

British Problems After the War.—An editorial with reference to a lecture delivered by Harold Cox before the (British) Institution of Civil Engineers on the problems that will arise in Great Britain after the war. "Undoubtedly the most immediate problem to be considered is the effect that will be produced by the disbanding of a large army, now amounting to some millions of men, by the discharge of large numbers of men and women now engaged in munition work, and by the expiration of separation allowances. It has taken a long time to bring about the change from normal times to the state of affairs which now exists, but the converse change from the present position required by the military situation to those of peace time will take place very much more rapidly. Apart from the reconstruction of roads and similar public works, which can be carried out easily by unskilled labor, there will be the rebuilding of factories and dwellings and other work which might be undertaken by the skilled workers in the ranks of our army." But there is a greater problem of maintaining the British industries on the proper basis. "After the war men will wish to continue the higher wages which they have recently enjoyed. Such wages, however, cannot be given unless the output per man is higher than it has been in times of peace." Moreover, if there is a greater output it is essential that there should be a larger market; and the point particularly emphasized by Mr. Cox is that if the workman has a higher wage he can produce a larger market at home by his increased spending power, thereby enabling his employer in turn to give the higher wage. To a large extent this is true, though it will operate more in some trades than in others. For example, the expenditure on the part of the workman will not go in the direction of engineering appliances, and, therefore, the manufacturers of engineering appliances must find their market elsewhere. The great difficulty, of course, is restriction of output. There is also the weight of establishment charges which has to be borne. If these can be diminished in any way it is all to the good of an undertaking. The simplest means of so doing, where there is considerable capital involved, is, no doubt, to run night shifts; preferably to run three shifts. The desirability of employers considering the well-being of their employees as one of their primary objects is strongly emphasized.—London *Electrician*, March 17, 1916.

B. J. ARNOLD

Bion J. Arnold of Chicago, who has just been appointed a member of the Naval Consulting Board to represent the American Society of Aeronautic Engineers succeeding Henry A. Wise Wood, resigned, is one of the country's best-known electrical engineers. For a number of years Mr. Arnold has devoted particular attention to electric railway work and besides conducting many important examinations into traffic problems both in this country and abroad, has served the city of Chicago as chairman of its Board of Supervising Engineers handling traction matters and rehabilitation work. Mr. Arnold is a past-president of the American Institute of Electrical Engineers and of the Western Society of Engineers, and acted as chairman of the executive committee and vice-president of the International Electrical Congress at St. Louis, in 1904.

C. R. Baldwin has resigned as manager of the Manhattan Electrical Supply Company, St. Louis, Mo.

T. A. Elder of Indianapolis, who has been general manager and operator of the various lighting plants of the Interstate Public Service Company of Indianapolis, has been transferred to Columbus, Ind., to take over the management of the company's plants in Columbus, Franklin and Greenwood, Ind.

P. O. Crawford, who was until recently an engineer in the employ of the Afghanistan government on hydro-electric installation, now has charge of construction of a 20,000-kw. water-power plant for the Siskiyou Electric Power & Light Company at Copco, near Hornbrook, Cal.

W. H. Thomson will become general manager of the Kansas City (Mo.) Light & Power Company, about June 1, according to an announcement by John H. Lucas, president of the company. For the last five years Mr. Thomson has been general manager of the Des Moines (Iowa) Electric Company.

J. W. Bivins, Jr. has been appointed manager of the Cordele (Ga.) Electric Company, succeeding H. M. Mason, who will take charge of another property of the Southern Utilities Company at Jacksonville, Fla. Mr. Bivins has been connected with the latter company since it took over the property of the Cordele company, three years ago.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Harry B. Putnam has been appointed president of the Westfield (Mass.) Power Company, succeeding Lewis C. Parker, who recently resigned.

Attilla Norman, general manager of the Oregon Power Company, has been appointed official delegate of the Eugene (Ore.) Commercial Club to the Chamber of Commerce of the United States.

W. J. Smith of Derry, N. H., has been appointed superintendent of the Jaffrey & Troy Electric Light Company of Troy, succeeding John Kenney, resigned.

R. P. McConnell, who has been appointed manager of the St. Clair County Gas & Electric Company, Belleville, Ill., was formerly division manager of the Philadelphia Suburban Gas & Electric Company, West Chester, Pa.

Charles L. Edgar, president of the Edison Electric Illuminating Company of Boston, and representative for Massachusetts of the American Institute of Electrical Engineers on the committee on industrial preparedness appointed by the Naval Consulting Board, has just been elected chairman of the Massachusetts directors. In a statement this week Mr. Edgar declared that the task before the committee is one of the biggest problems ever placed before the engineering fraternity of the United States, but added that the work is being taken up by engineers with the greatest enthusiasm.

Richard T. Sullivan, superintendent of the Houston (Tex.) Electric Company, was presented with a gold watch by his associates and employees on April 13, prior to his departure from Houston to become railway manager of the Mahoning & Shenango Railway & Light Company, with headquarters in Youngstown, Ohio.

G. H. Ahlborn, manager of the new-business department of the Ohio Electric Company at Zanesville, Ohio, for the past six months, has been appointed superintendent of the local railway division and electric properties of the company, succeeding G. D. Nicoll, who will take charge of the Ohio Electric Company's system in Dayton, Ohio.

R. L. McLellan, who has joined the Chicago sales staff of the Westinghouse Electric & Manufacturing Company, in charge of steam-railroad business in the Chicago territory, was formerly commercial manager of the Merchants' Heat & Light Company of Indianapolis, Ind. Mr. McLellan was for several years also a member of the field commercial organization of H. M. Byllesby & Company, Chicago, but had recently been with Sanderson & Porter, consulting engineers, Chicago.

E. B. GREENE

Edgar B. Greene, for twenty-nine years active in central-station work at Altoona, Pa., will resign on May 1 as general superintendent of the Penn Central Light & Power Company, in order to go to Florida where he will engage in farming and stock raising. Mr. Greene has not been in good health for several years and expects to be benefited by the Southern climate. He first came to Altoona in 1887 as manager of the old Edison Electric Illuminating Company which then had only six employees. When the company was taken over by the Penn Central Company Mr. Greene was made superintendent of plants, and four years ago he succeeded E. T. Penrose as general superintendent.

C. R. Hodgson has been appointed division manager of the Philadelphia Suburban Gas & Electric Company, West Chester, Pa. Mr. Hodgson was formerly local manager of the Northern New York Utilities, Inc., at Carthage, N. Y.

Charles J. Murphy of Brookston, Ind., has tendered his resignation as a member of the Public Service Commission of Indiana to Gov. Samuel M. Ralston, and the resignation has been accepted, effective May 1. Anthony Deahl, an attorney of Goshen, Ind., has been appointed by the Governor to take Mr. Murphy's place.

J. J. Carty, chief engineer of the American Telephone & Telegraph Company and president of the American Institute of Electrical Engineers, was presented with a punch bowl set at a "welcome home" meeting of employees of the New England Telephone & Telegraph Company, held in Symphony Hall, Boston, on April 19. In an address on the future of telephony, Mr. Carty predicted the extension of radio telephone communication throughout the world, but maintained that wire telephony will remain firmly intrenched in its field of simultaneous individual communication.

Obituary

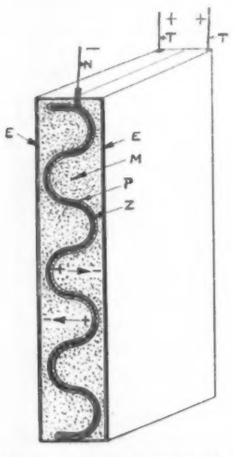
William H. Cappell, superintendent of the Chicopee Falls (Mass.) plant of the New England Westinghouse Company, died suddenly at Hollis, L. I., on April 23. He was about forty-five years of age.

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Flat-Type Dry Cell

In the accompanying illustration is shown a sectional view of a flat type of dry cell which, according to the manufacturer, the Cleveland Battery & Electric Company, 1974 East Sixty-sixth Street, Cleveland, Ohio, is in many respects an improvement over the ordinary round cell. Instead of the round type of zinc container generally used, a flat one has been adopted and the design of the cell is similar to that of a lead-plate storage cell. The positive element consists of a zinc sheet, *Z*, incased in a porous envelope, *P*, completely surrounding it, which is embedded in the electrolytic and depolarizing material, *M*. Next to this material or "mix" lie the negative elements of electrodes *E E* which, taken as a unit, form the container of the cell. Thus the energy generated at the zinc element has two paths through the mix (as shown by arrows) to the electrodes (which act merely as non-corrosive collectors) and emerges at the terminals *T T* which, connected together, form the positive pole of the cell, the zinc terminal *N* being the negative pole. This construction is a reversal of that of the common round cell, in which the carbon-rod electrode is in the center. The electrodes are of such a low resistance, it is claimed (considerably under 1/1000 of an ohm), as to give a uniform energy distribution. They are



SECTIONAL VIEW OF FLAT DRY CELL

flexible, non-breakable and non-corrosive, and are 1/32 in. thick. Since the distance separating the zinc element from its container remains constant, the output of the cell varies directly as its area and weight. Furthermore, owing to the fact that the contact area of the zinc element with the depolarizing material is large, the depolarizing power is also said to be quite large. Batteries of from two to eight cells connected in series and sealed under pressure in waterproof, non-corrosive containers are now being placed on the market.

Hatching and Raising Chicks by Electricity

Although the application of electricity to the poultry industry is comparatively new, the field offers a most fruitful opportunity to central stations

FIG. 1—ELECTRIC INCUBATOR

for the sale of electric service. There are probably between 2,500,000 and 5,000,000 lamp-heated incubators and hovers, it is claimed, in this country, which if electrically heated would use between $10,000,000 and $15,000,000 worth of energy. The character of this load is a highly desirable one from the central-station standpoint. It comes on in January and February, when the revenues from many sources are decreasing, and continues until May or June. During this period the business is practically a 100-per cent load factor, as the apparatus has to be kept heated continuously.

On account of its simplicity of control a much more uniform temperature is obtained in the electric incubator than can be obtained with most other forms of heating. Since a uniform temperature is the prime requisite of successful artificial incubation, the electric machine has a decided advantage. In addition there is no possibility of the heating units vitiating the tray inside the machine, and the germ develops in pure vitalizing atmosphere. Most electric machines are designed so that the heating units operate at a low temperature, usually not higher than 300 deg. Fahr., so that the fire hazard is reduced to a minimum. In Figs. 1 and 2 are illustrated electric incubators and hovers manufactured by the Electric Specialty Company of Salt Lake City, which is making units with capacities of 100 eggs, 200 eggs and 600 eggs. On account of the necessity for conserving the heat as much as possible where electricity is used as the heating agent, the boxes of the machines are provided with double walls on the top, bottom and all four sides. Continuous coils are used for the heating units, giving a uniform distribution of temperature, it is claimed, on all portions of the egg tray. Mercury-cup contacts are used in the electric regulators. A 2-cp., 110-volt lamp controlled by a push-button switch is located at a convenient point in the machine, and it provides light for reading the thermometer and inspecting the contents from the glass window in the inner front door. The electric hovers employ the same heating system, and automatic regulator as is used in the incubator. The hover has a miniature incandescent lamp under it, which keeps the interior lighted and attracts the chicks under the hover when it begins to get dark outside.

The Electric Specialty Company has also developed a heating unit for installation in lamp-heated machines and converting them to electric machines. The same types of heating units, lighting equipment, and automatic electric regulator are provided with the conversion set, as installed in the standard electric machines. This equipment can be installed in practically any kind of lamp-heated incubator, it is pointed out, in a few hours by any one handy with tools. The company re-

FIG. 2—ELECTRIC HOVER

ports that several incubator concerns having large plants have recently adopted electric heating for their machines formerly heated by lamps, Among these are a 2200-egg plant at Midvale, Utah, and a 2000-egg plant at Carson City, Nev. Each plant will consume about 300 kw.-hr. per month with a maximum demand of approximately 500 watts.

Tungsten Spot or Lens Lamp

In the accompanying illustration is shown what is designated by the manufacturer, the Sprague Electric Works of the General Electric Company, 527 West Thirty-fourth Street, New York City as a Mazda spot or lens lamp, which has been developed for use as a substitute for the ordinary arc-lamp hand-fed device employed for stage lighting and other purposes for which a portable illuminating device of the

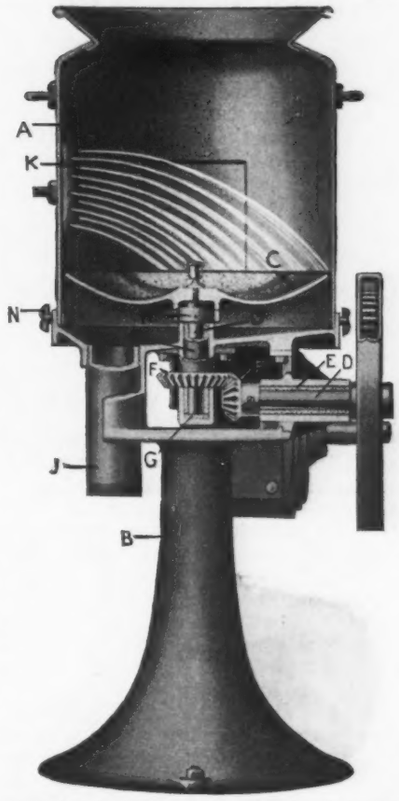
SPOT OR LENS LIGHTING DEVICE EQUIPPED WITH GAS-FILLED LAMP

type shown is adapted. A gas-filled lamp is employed as the illuminant and the fixture is designed especially for projecting purposes in theaters, assembly halls and motion-picture houses. According to the manufacturer, it can also be employed as a flood-lighting unit from the balcony or gallery of a theater or as a spot light from the same location. The hood of the device is substantially constructed and is of neat appearance. This hood is well ventilated and no part of the exposed surface, it is declared, attains a greater temperature than 200 deg. Fahr. when in continuous operation. The hood is built with an inner and outer body, thus permitting the circulation of air around the lamps at all times. The hood is mounted on a telescopic stand which allows for raising or lowering it at will, while a swing-joint attachment permits operation of the light in any direction desired. The device has been designed to meet the requirements of the National Board of Underwriters.

Electrically Operated Vegetable-Paring Machines

In the kitchens of hotels, restaurants, clubs, public institutions, etc., and on board ships, the vegetable-paring problem is ever present. When done by hand, the expense of peeling such vegetables as potatoes, turnips, carrots, onions, etc., is considerable for both labor and unnecessary wastage. To avoid hand peeling, the American Machinery Company, 1225 Callowhill Street, Philadelphia, Pa., has developed several types of compact electrically operated paring machines, one of which is shown in section in the accompanying illustration.

These machines are designed to remove, solely by friction, the whole of the outer skin from potatoes, carrots, turnips, etc., and turn them out perfectly pared, smooth, clean, and in their natural shape, ready for cooking. According to the manufacturer, the machines will do the work quite irrespective of the original condition of the vegetables, with a wastage 50 per cent less than is possible by the most expert hand paring. One machine, it is claimed, will do as much work, and do it better, than can be done by ten to fifteen persons paring by hand. The machines will pare potatoes, etc., with an average wastage of 10 per cent.



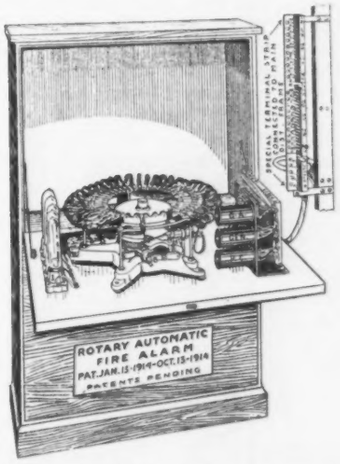
SECTIONAL VIEW OF PARING MACHINE WITH CARBORUNDUM DISK

Moreover, they will also pare potatoes too small to be pared by hand, and that would otherwise be thrown out and wasted.

The paring operation is accomplished by means of friction disks of carborundum imbedded in metal. The motors used to operate the machines are of water-proof construction. To operate the machine, the motor is first started and then the water is turned on and enough unwashed potatoes or other vegetables are placed in the cylinder almost to fill it. The friction disk at once causes the contents to take a rotary motion and to come in contact with a water sprinkler fastened to the side of the cylinder. The vegetables are then brought back to the center of the disk, and from here they are again taken to the side of the cylinder, and so the movement of the contents is repeated. The water is constantly sprayed over the vegetables, thoroughly washing and cleansing them and carrying off parings, dirt, etc., from the machine through the waste outlet to the sewer. When the vegetables are sufficiently pared, the door is opened—without stopping the machine—and the clean vegetables are emptied into the receptacle placed to catch them.

Fire Alarm for Use With Telephone Systems

An automatic rotary fire alarm has been developed by the Volunteer Firemen Signal Company, 119 Fifth Street, S. E., Minneapolis, Minn., to meet the demand for a fire-signaling device which can be operated in connection with telephone systems. According to the manufacturer, about 90 per cent of fire-alarm calls are received over the telephone, and the telephone companies in many places are required to furnish fire-alarm service for volunteer fire departments. The device shown herewith has been designed to eliminate the operating trouble for the telephone company. The apparatus can be used in connection with existing telephone systems, employing the telephone circuits and bells for fire-alarm purposes without interfering with the normal operation of the system. It is particularly well adapted for use in hotels, factories, mines, public buildings and for calling firemen in towns having volunteer fire departments, or at any place where the telephone system might be utilized for such purposes. The spring groups are mounted on a nickel-plated mounting bar and wired to a special terminal mounted in the cabinet. The ringing



ROTARY FIRE ALARM DESIGNED FOR USE WITH TELEPHONE SYSTEMS

of the lines is accomplished by means of a heavy spring motor. There are five insulated rollers mounted on the spring drum of the motor and when set in motion the rollers pass under the spring groups, raising the master spring in contact with the ringing circuit, breaking the line to the switchboard so that it does not interfere with

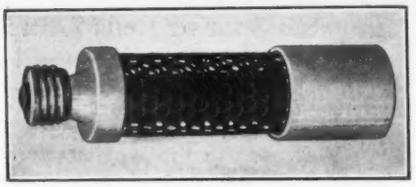
the drops or signals on the board. The motor revolves once and stops, thus giving each line five distinct rings as a fire signal. When installed in a hotel or other places where more than one alarm would be necessary, the operation of the motor can be continued and any number of alarms sounded. A buzzer is installed on the machine and notifies the operator of the starting and stopping of the machine. There are also five 660-ohm lamps installed in the machine. Each one of these lamps is in series with the ringing circuit. Two relays are also utilized, one of which operates simultaneously with the starting of the machine, the contact springs of which are connected in multiple with the pole changer, or ringing power switch, so that in case the source of ringing power is cut off after business hours, the machine automatically operates the relay, thereby starting the pole changer or source of ringing power. This provision has been made to take care of cases where exchanges are closed at night, or on Sundays, where the alarm might be turned in from the street from a weatherproof telephone or pull box. The second relay is for operating a general alarm. The apparatus is contained in a cabinet built with two compartments, the upper half containing the mechanism and the lower half the batteries for charging the machine in magneto exchangers. The motor is wound from the outside, thus doing away with the necessity of opening the door to wind it.

Charging Set for Gasoline Automobiles

For charging small storage batteries utilized on gasoline-operated cars the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has developed the outfit shown in the accompanying illustration. The equipment is simple and compact, and consists of a motor-generator set which can be connected to ordinary 110-volt or 220-volt, 60-cycle, alternating-current or 115-volt or 230-volt direct-current lighting circuits. The motor-generator set takes power from the line and generates direct current at a voltage slightly higher than that of the battery. The panel and the charging set are completely wired before shipment. The operation of the outfit is quite simple. The motor is first connected to the supply circuit and then started by means of a snap switch. The battery is connected to the generator terminals and the ampere charging rate adjusted by means of the field rheostat to the value shown on the battery nameplate. The charging is continued according to the method recommended by the battery manufacturer. As the generator is shunt wound, its voltage increases as the ampere load decreases. This is, as the battery approaches a charged condition the potential of the generator automatically rises to the higher value required for finishing the charge. This voltage characteristic is said to be a great advantage where lead batteries are to be charged, because it permits the operator to give the battery an equalizing or long-period low-rate charge which prolongs the life of the lead battery. The complete equipment includes a motor-generator set and a charging panel with the necessary controlling rheostat, motor, switches and fuses. The ammeter shows the ampere charging rate which can be adjusted by the rheostat. Snap switches and fuses control both the motor and generator, conforming to all the requirements of the Fire Underwriters.

Convenient Resistance Unit Equipped with Screw Plug and Socket

An "Adaptor" enameled resistance unit, as it is called, equipped with an Edison-base screw plug at one end and an Edison socket at the other end, is shown in the accompanying illustration and has been developed by the Ward Leonard Electric Company, Bronxville, N. Y. The unit provides a convenient means of interposing resistance in a circuit and, according to the manufacturer, can be furnished in any rating or size required. It is being utilized quite extensively, it is pointed out, to enable one to employ "universal-type" motors on either alternating-current or direct-current circuits at any given constant speed. It is also used in connection with low-voltage apparatus when connected to circuits of higher voltage than that for which the apparatus is designed. The unit consists of

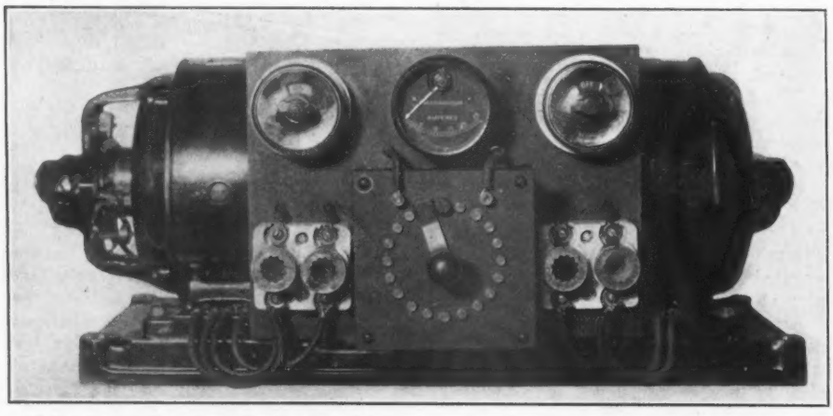


RESISTANCE UNIT WITH SCREW PLUG AT ONE END AND SOCKET AT OTHER

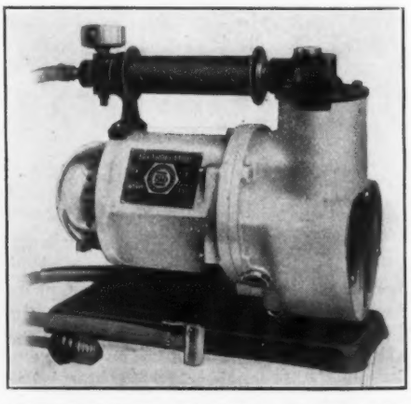
a porcelain tube having a low-temperature coefficient wire wound upon it. The joint between the resistance wire and the terminal lead is made while the parts are bright and clean and under high pressure. The entire resistance winding as well as the joint is imbedded in a coating of vitreous enamel, which thoroughly protects it, it is declared, from electrical, chemical or mechanical disintegration.

Electric Tire-Inflator

A type B "Lectroflater," just brought out by the Black & Decker Manufacturing Company, Baltimore, Md., has a number of improvements incorporated in its design. The machine has been developed especially for use in inflating automobile tires, and consists of a high-pressure air compressor operated by a universal motor. All parts are automatically cooled by a special cooling system, which requires no liquid of any kind. All bearings and gears and piston are automatically lubricated from a central source by the capillary system; since there is no liquid lubricant or oil level to maintain, there can be no flooding, and it is impossible for any oily vapor to get into the tires with deleterious effects. The machine is neat in appearance, light in weight and is equipped with long attachment coil, high-pressure gage, hose and quick-acting plug. It is being made in two sizes, the No. 1 machine being designed for use in private garages and the No. 2 machine with capacity two and a half times as great as the No. 1 machine for use in public garages, tire salesrooms, etc. The machines can be provided with attachments for mounting on the wall and the No. 2 can be mounted, if desired, on a light seamless steel tubular carriage, having large diameter wheels and tool tray.



MOTOR-GENERATOR SET FOR CHARGING BATTERIES FOR GASOLINE-OPERATED CARS



TIRE-INFLATING MACHINE IN OPERATION

Screw Anchor with Improved Attachment

W. N. Matthews & Brother, St. Louis, Mo., have equipped their "Scrulix anchor" with an attachment called the

SCREW ANCHOR WITH ATTACHMENT CONSISTING OF THIMBLE, PULLEY AND EYE

"Thimpuleye" which combines in one device a thimble, a pulley and an eye. It is claimed that this device will enable an operator to save from five to ten minutes of the time formerly employed in pulling the slack out of the guys—that is, of lining up the oval-shaped thimble formerly utilized. It is also pointed out that the device cannot crush under strains, because the section of the eye on which the thimble rolls is only 1/16 in. less in diameter than the inside diameter of the thimble.

Reflector Holder

A new holder has recently been brought out by the George Cutter Company, South Bend, Ind., which is adapted especially for use with the company's standard 2.25-in. and 3.25-in. heel reflectors. The holder has been developed, the manufacturer points out, to take the place of the many styles of holders previously included in its line,

HEEL REFLECTOR ATTACHED TO HOLDER

and to eliminate the need of various types of reflector heels. It is designed for mounting directly on 0.5-in. conduit and consists of a galvanized and enameled canopy and a standard socket. The canopy serves as a rigid holder for the reflector and also as a protection to the socket. Keyless porcelain or brass-shell pull-chain, "Shurlok Medium" screw sockets and porcelain "Mogul" screw sockets with or without a "Shurlok" attachment, may be utilized with the holder, according to the requirements of the installation. Standard heel reflectors of any type or size, the manufacturer asserts, fit readily into the holder and are locked in position by means of a thumb screw.

Double-Acting Piston Pump

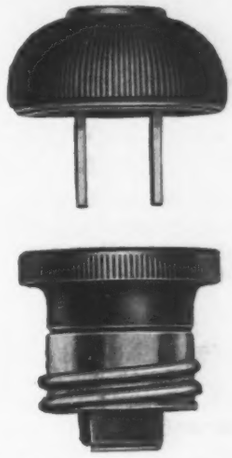
The Goulds Manufacturing Company, Seneca Falls, N. Y., has added to its line of electrically operated pumps the motor-driven "Pyramid" brass-lined, double-acting piston pump shown herewith. The machine has a capacity of 6 gal. per minute against heads up to 100 ft. It is said to be especially adapted for use with elevated-tank water-supply systems on farms and in country homes, mills, small factories,

DOUBLE-ACTING PUMP DRIVEN BY 0.25-HP. MOTOR

etc. The pump is 2.5 in. by 4 in. in size and is driven by a 0.25-hp. motor which is mounted on brackets attached to the pump, as illustrated.

Separable Attachment Plug

Several electrical manufacturers have agreed on the making of standard plugs and receptacles, the caps and bodies of the various makes of which can be interchanged. In the accompanying illustration is shown the "C-H No. 7700" standard-type separable plug, as it is called, recently brought out by the Cutler-Hammer Manufacturing Company of Milwaukee. This device is an all-composition plug, of small size and rated at 660 watts at 250 volts. The plug shown in the illustration is approximately of full size. The knurled cap, it is declared, does not wear shiny when used, nor show the results of scratches; in fact, the appearance of the knurled cap, it is claimed, improves with use, and since the cap is the portion of the plug that shows when in service this feature is of considerable importance. The contact blades are securely

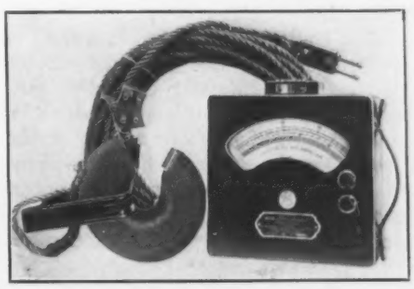


SEPARABLE ATTACHMENT PLUG WITH KNURLED CAP

riveted to the cap, and are held in perfect alignment, it is declared. No screws are used except those provided for securing the cord terminals. All live parts are concealed.

Alternating-Current Testing Set

The current testing set shown in the accompanying illustration consists of a split-core transformer, an ammeter and a cord to connect the two devices, and is designed to test alternating-current lines. The transformer is so constructed that it can be slipped over the line (either primary or secondary) and with the connecting cord plugged into the ammeter, the line current is indicated on the meter. According to the manufacturer, a feature of the set is the three working ranges (namely, 0.30 amp. 0.125 amp. and 0.250 amp.) making it possible to read currents as low as 5 amp. as readily as 250 amp. The different scales are available for use without any change in external connections; therefore the set operates with



ALTERNATING-CURRENT TESTING SET WITH THREE WORKING RANGES

maximum efficiency. The transformer can be slipped over a cable 1.125 in. in diameter. The set is being placed on the market by the Western Electro-Mechanical Company, Oakland, Cal.

NEWS OF THE INDUSTRY

A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields

Meetings of the Associated Manufacturers of Electrical Supplies

A meeting of the board of governors of the Associated Manufacturers of Electrical Supplies was held at the Hotel Biltmore, New York, on April 19, when standing committees for the ensuing year were appointed, as follows:

Membership Committee.—W. C. Robinson, chairman, National Metal Molding Company, Pittsburgh, Pa.; Oscar Hoppe, American Circular Loom Company, New York; H. T. Paiste, H. T. Paiste Company, Philadelphia, Pa.; B. E. Salisbury, Pass & Seymour, Inc., Solvay, N. Y.; W. S. Sisson, D & W Fuse Company, Providence, R. I.; J. H. Trumbull, Trumbull Electric Manufacturing Company, Plainville, Conn.; Walter D. Steele, Benjamin Electric Manufacturing Company, Chicago, Ill.

Finance Committee.—J. F. Kerlin, chairman, National Carbon Company, Cleveland, Ohio; W. C. Bryant, Bryant Electric Company, Bridgeport, Conn.; Charles L. Eidlitz, Metropolitan Electric Manufacturing Company, Long Island City, N. Y.; R. E. Gallaher, New York Insulated Wire Company, New York; J. M. Shreve, Habirshaw Electric Cable Company, New York.

Legal Committee.—D. C. Durland, chairman, Sprague Electric Works, General Electric Company, New York; LeBaron C. Colt, National India Rubber Company, Bristol, R. I.; D. H. Murphy, American Conduit Manufacturing Company, Pittsburgh, Pa.

Publicity Committee.—A. W. Berresford, chairman, Cutler-Hammer Manufacturing Company, Milwaukee, Wis.; John C. Bridgman, Hazard Manufacturing Company, Wilkes-Barre, Pa.; L. J. Campbell, Western Conduit Company, Youngstown, Ohio; S. B. Condit, Jr., Condit Electrical Manufacturing Company, Boston, Mass.; Harvey Hubbell, Harvey Hubbell, Inc., Bridgeport, Conn.

A special meeting of the lamp receptacle and socket section was held on April 19 at the Hotel Biltmore, New York. There was a full attendance, and many matters of importance were considered.

On April 19 at the Hotel Biltmore, New York, the chairmen of the various sections of the Associated Manufacturers of Electrical Supplies had a very interesting meeting, at which W. H. Merrill, president of the Underwriters' Laboratories, and Dana Pierce, vice-president of the Underwriters' Laboratories, were present. Mr. Merrill extended an invitation to the chairmen to visit the Laboratories, with a view to becoming familiar with their method of inspection, standardization, etc., and in acceptance of this courtesy the following committee was appointed for this purpose: Shiras Morris, chairman of the snap switch section; B. E. Salisbury, chairman of the lamp receptacle and socket section, and H. R. Sargent, chairman of the fuse section.

A special meeting of the fuse section was held on April 20 at the Hotel Biltmore, New York, at which all members of the section were present. W. H. Merrill, president, and Dana Pierce, vice-president of the Underwriters' Laboratories, were present at this meeting, and at the invitation of the chairman of the section, H. R. Sargent, Mr. Merrill addressed the members informally on matters of standardization, etc., discussing the various methods employed by the Laboratories along these lines.

On April 26 the molded or formed insulation section held a meeting at the Hotel Biltmore, New York. E. B. Hatch, the chairman, presided and the various subcommittees of the section made important reports.

The wire and cable section held a very interesting and important meeting on April 18, at the Hotel Manhattan, New York. The meeting was preceded by a dinner, at which all members of the section were present, in addition to a number of guests. At this meeting many suggestions for new activities of the section were considered and plans formulated for action. Several subcommittees, covering the various lines of industry embodied in this section, were appointed and it is expected that they will have important and interesting reports to make at a later meeting.

A complete report of the annual meeting of the Associated Manufacturers of Electrical Supplies, held on March 16, at the Hotel Biltmore, New York, has been prepared by the general secretary, Charles E. Dustin, and will be ready for distribution to all members of the association this week. This report gives a full and interesting account of all action taken at the annual meeting, together with all details of the social session and banquet held in the evening of the same day at Delmonico's, New York.

General Electric Received Orders in 1915 Totaling $98,385,891

The value of orders reecived by the General Electric Company during 1915 for electrical apparatus and devices only, being exclusive of the orders for special war munitions, it was stated by C. A. Coffin, chairman of the board of directors, at the annual meeting on April 21, was $98,385,891. This was an increase of $14,637,370 or 17 per cent over 1914.

Special war munition orders were so restricted as to interfere as little as possible with the regular products of the company. From these orders, the total of which received during 1915 was $33,980,000, Mr. Coffin pointed out, the percentage of profit will probably be less than that of the average of the company's output.

The sales billed during the year amounted to $85,522,070, which was a decrease of $4,945,621 or 6 per cent over the preceding year. The profit from this business amounted to $8,623,887. Income from other sources brought the total net income of the company up to $12,307,995, of which, after paying interest and dividends, $3,607,991 was carried to surplus, making the total surplus at the end of 1915 $23,692,871.

Stocks, bonds and other securities are carried at a valuation of $32,916,593, of which $19,687,965 represents securities of subsidiary companies, and the remainder those of public utility and other companies. The current accounts and notes receivable are carried at $19,619,216.

At the end of 1915 the company had in its employ 60,000 persons.

The total floor space occupied by the company in 1915

was 14,830,000 sq. ft., which was less than that of the previous year by 10,000 sq. ft. This was on account of the sale of several small factories which more than offset the manufacturing floor space added in 1915. Plant expenditures amounting to $4,485,069 were chiefly for improvements in existing construction and equipment and the purchase of special tools and machinery. Because of the nature of these expenditures and on account of the liquidation of the book value of the factories sold, the reduction in the plant account for the year was $5,985,069. The book value of all plants at Dec. 31, 1915, amounted to $29,563,331.

A condensed statement of the profit and loss account for the year ended Dec. 31, 1915, follows:

Sales billed		$85,522,070
Less: cost of sales, including all operating, maintenance and depreciation charges		76,898,183
		$8,623,887
Interest and discount	$1,434,269	
Income from securities owned	1,554,843	
Sundry revenues	694,996	
	$3,684,108	
Less: Interest on debenture bonds	570,085	
		3,114,023
		$11,737,910
Dividends paid		8,129,918
Net surplus for the year		$3,607,992
Surplus at Jan. 1, 1915		20,084,879
Surplus at Dec. 31, 1915		$23,692,871

Convention Dinner of Lighting Sales Bureau

Chicago men interested in electric lighting sales are planning a Lighting Sales Bureau banquet to be held during the N. E. L. A. convention at Chicago. Although the exact time and place at which the meeting is to be held has not yet been decided upon, these details are being rapidly worked out. John G. Learned, assistant to vice-president of the Public Service Company of Northern Illinois, Chicago, has the affair in charge.

Electric Flag Presented to City of Athens, Ga.

Tuesday, April 11, was "flag day" at Athens, Ga., and the occasion was fittingly celebrated by street parades, patriotic demonstrations and the lighting of a large electric flag on the City Hall. In the morning at sunrise there was a flag salute by the University of Georgia cadets. Shortly before noon there were street parades with special music and addresses. There were also band concerts at intervals in different parts of the city. At night patriotic exercises were held in connection with the unveiling of a large electric flag over the city building presided over by C. D. Flanigan. The emblem was presented to the city by Judge J. J. Strickland on behalf of the Chamber of Commerce and accepted by Mayor R. O. Arnold. The ceremonies were closed with addresses, chief among which were those made by Samuel L. Olive of Augusta, Ga., and John Temple Graves of New York.

THE ELECTRIC FLAG ON THE ATHENS CITY HALL

THE PARADE PRECEDING THE "FLAG DAY" CEREMONIES

Protecting Canadian Power Plants on Niagara Frontier

So great is the fear that the big Canadian power plants at Niagara Falls, Ont., will be destroyed and otherwise crippled by German secret agents that the Dominion authorities have ordered the erection of barbed-wire entanglements along part of the frontier of Canada in the vicinity of the electric generating plants. The present armed guard has been greatly increased by the arrival of additional troops from near-by concentration camps.

The area of the Victoria National Park about the plant has been closed to the public. Arc lamps have been erected to illuminate the fence at night and the cars of the Great Gorge Route Railway, which passes close to the power house while making the loop in the vicinity of the Canadian Horseshoe Falls, are escorted through the inclosures under armed guard.

Boston Street Lighting Arbitration

Arbitration of the prices of street lighting as set forth in the latest contract between the city of Boston, Mass., and the Edison Electric Illuminating Company, was taken up by the Massachusetts Gas & Electric Light Commission on April 20. By the terms of the contract, signed on Dec. 7, 1916, the price per 500-watt 6.6-amp. direct-current magnetite arc lamp burned 3828 hours per year is $87.53. This price, as well as the price of other street lamps, is to be arbitrated by the board and made retroactive to July 1, 1915. The parties agree that if, as a result of the investigation, the board shall determine that a fair price for the entire service supplied to the municipality is less than the total amounts to be paid according to the company's street lighting schedule, one or more of the rates charged according to the schedule may be reduced by the commission in such manner that the total payments by the city shall not be less than the fair price for the entire service as determined by the board.

Leonard L. Elden, electrical engineer of the company, was called as an expert witness to explain data submitted by the company upon the cost and revenue of its Boston street lighting service. On account of the earlier negotiations the income and operating cost of the street lighting system were determined on the basis of the

number of lamps connected Nov. 30, 1914. The yearly income from arc lamps was $401,201 (4543 magnetite lamps at $87.53 and twenty-four Thoran lamps at $148.05); from incandescents, $78,517, and the total street lighting income was $479,718. The total cost of operation and maintenance was $284,627, leaving a gross profit of $195,091 available for proportion of general expenses, taxes, dividends and depreciation.

The cost of operation and maintenance was made up of the following principal items: Production and substation costs, $98,875; operating and maintaining lamps, $107,091; operating lines and fixtures, $11,189; maintaining lines and fixtures, $58,862; stock-room expense, $6,608; records and billing, $2,000.

The average cost of energy per kilowatt-hour sold for the year ending Nov. 30, 1914, not including the cost of distributing from substations, was:

Generating expenses:		
Operating		$944,129
Maintenance and repairs		114,988
		$1,059,117
Substation expenses:		
Operating	$210,969	
Maintenance	57,909	268,878
		$1,327,995
Total kilowatt-hours delivered to high-tension substation bus		180,049,909
Cost per kilowatt-hour delivered to high-tension substation bus, cent		0.7375

Energy delivered to high-tension substation buses for street lighting was 13,406,884 kw.-hr.

The company presented the following pro-rated investment costs per arc lamp, as of Nov. 30, 1914:

General office, land, buildings, equipment	$9.21
Service buildings property	17.08
Laboratory	.92
Records	1.07
Transportation and repair equipment	4.15
General stock	6.28
Stock arc lamps and parts	1.20
Substations, land and buildings	14.35
Generating station (arc lighting demand, 3223 kw.; system demand, 65,342 kw.; $116 per kilowatt) maximum load	81.86
Transmission lines (cable and conduit)	4.84
Transmission lines (switching apparatus)	.78
Converting apparatus (brush arc generators, rectifiers, motor generators)	61.29
Lamp poles, 4567	61.06
Arc lamps, 4567	27.71
Conduit for arc circuits, 797,523 ft.	109.98
Cable, 2,611,298 ft.	165.95
Manholes, 3397	31.54
Poles, 5850	19.59
Wires, 1,844,269 ft.	16.15
Total per arc lamp	$635.01

Total arc lighting investment $2,900,118.

Other figures prepared gave a total investment in series incandescent lighting equipment of $180,860 for Boston, and an investment of $288,470 in multiple incandescent street lighting. The investment per street incandescent lamp is $114.95. The total investment for arc and incandescent street lamps is $3,369,448. The annual operating expenses per arc lamp are as follows:

Production and substation costs	$17.80
Production and substation general expenses	1.26
Repairs, overhead lines	3.12
Repairs, underground cables	4.71
Repairs, underground conduit	.45
Repairs, lamp poles and fixtures	3.02
Operating overhead lines	.75
Operating underground cables	.48
Operating underground conduit	.51
Rental of attachments	.14
Trimming 4567 lamps	10.63
Patrolling	2.03
Repairing	2.84
Stock room expenses	1.00
Maintaining records and billing	.22
Total per arc lamp	$48.96

The above figures do not include taxes, administration, supervision, legal, liability insurance, pension and sick benefit expenses and capital investment necessary to carry on the business.

On the above tabular basis the annual operating expenses per series incandescent lamp are $12.98 and per multiple incandescent street lamp $15.59. There were 2299 series incandescents and 1784 multiple incandescents in service.

Public Service Commission News

Vermont Commission

The Public Service Commission has issued a decision denying the Central Vermont Power Company, Montpelier, authority to issue $20,000 in capital stock, on the ground that it is not the policy of the board to authorize the issue of securities without definite information as to the expenditure of the proceeds of such issue and sale. The decision holds that "supervision over the issue of stock and bonds is given to the commission for the purpose of protecting the public from over-capitalization, which evil is always reflected in rates, and for the purpose of protecting the investor by insuring the proper expenditure of his investment in public utility securities."

Maine Commission

The Public Utilities Commission has authorized the Milo Electric Light & Power Company to furnish electricity in the town of Sebec. It is planned to install a 6600-volt, two-phase system, serving individual or grouped farm customers at reduced cost. The Penobscot Bay Electric Company had been authorized to furnish a similar service in the town, but so far as the evidence before the board showed, no steps toward this had been taken. The petition of the Milo company was granted on the ground that it would not result in the duplication of any system now established or impair any existing investment in properties serving the territory.

New York Commission

The Public Service Commission for the Second District has approved the franchise granted the Niagara, Lockport & Ontario Power Company by the village authorities of the village of Skaneateles for a transmission line from the point where the company now supplies the village municipal plant with energy outside the village limits, to a substation within the village. The commission was of the opinion that as the new line is not one that will enter into competition with the village plant by supplying energy to any customer except the village, its franchise is not one for the granting of which the village law requires a vote of the village electors.

Montana Commission

Holding that the State, and not the city, has the power of regulating public utility rates, the District Court has handed down a decision upholding the reduction of discounts from 10 per cent to 5 per cent made by the Montana Power Company upon order of the State Utilities Commission.

The question before the court was whether the State commission could make an order that in effect nullified that clause in the charter which the city had granted the power company governing its discount for payments within a given period, or whether the charter rate would take precedence.

After reviewing the facts of the case, the court held that "rate-making is a legislative act; it is inherent in and belongs primarily to the Legislature. Unless the State has surrendered this sovereign authority and delegated to the municipality the power to fix certain rates for a definite period, though the grant and acceptance of the franchise in this case created a contract between the parties to it, the rates thereby fixed are, nevertheless, cognizable for revision by the Public Service Commission. There is no delegation, expressed or by implication, of power which authorized the city to contract inviolably for the rates mentioned in the franchise."

Maine Commission Makes First Annual Report.—The bound volumes of the first annual report of the Maine Public Utilities Commission have just come off the press. The commission first took up its duties in November, 1914.

Movement on Foot to Repeal North Dakota Utilities Law. — Maintaining that the public utilities law passed by the last Legislature, under which the power of fixing rates of water, gas, electric light, heat and power companies is taken from the city governments and bestowed upon the State Railroad Commission, is unfair in that it provides no remedy for the public in the event that it may be dissatisfied with a rate fixed by the commission, a determined effort, it is reported, will be made to bring about the repeal of the measure, or at least its amendment, in the next session of the State Legislature.

Public Safety Campaign for Altoona. —Altoona, Pa., will have a public safety campaign on the first four days in May. The campaign will be given under the auspices of the local Chamber of Commerce and under direction of the State department of labor and industry, in co-operation with the Pennsylvania Railroad Company, the Altoona & Logan Valley Electric Railway Company, the Schwarzenbach-Huber Company, the Penn Central Light & Power Company, the public and parochial schools and various civic organizations. The campaign will be in the form of motographic entertainments.

San Francisco Companies Enter Into Joint Pole Agreement.—The drafting of a joint pole agreement by representatives of all public service corporations maintaining overhead wires in San Francisco, Cal., was begun on April 11. It was decided to allow poles already up to remain the property of the companies that erected them, and to have these companies grant perpetual easements to other companies. Joint occupancy of the poles can thus be assured on equitable terms, it was said, while the accounts to be kept in regard to the poles will be simplified. Joint ownership will be provided for where several companies wish to erect new poles at the same time.

Commonwealth Edison Company Adds Rifle Club to Recreations for Employees.—In keeping with the spirit of the times, Guy Lund, chief electrician of the Fisk & Quarry Street stations of the Commonwealth Edison Company, and chairman of the recreations committee of the company section, N. E. L. A., has added a rifle club to the various activities for the employees as an outgrowth of the Fisk and Quarry Rifle Club, which has been in active existence for more than a year. One range has been fitted up in the company's former office building at 120 West Adams Street, with nine targets, and another at the northwest station, in addition to the one at Fisk Street station. The employees are showing remarkable interest in the new sport, and Mr. Lund predicts that it will be the largest recreation club of the company section by the end of next season.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Taking Census of Kansas Light and Power Plants.—Carl W. Moore, secretary of the Kansas Public Utilities Commission, is taking a census of the electric light and power companies and plants in the State. It is believed there are a number of plants that have not filed statements of rates and regulations governing service, as required by the utilities act.

New Lighting System Proposed for San Francisco Civic Center.—At a recent meeting of the San Francisco Board of Supervisors, there was presented a set of plans prepared by W. D'A. Ryan, for illuminating the Civic Center. It is proposed to use five-lamp standards similar to those designed for Market Street and described on page 471 of the ELECTRICAL WORLD of Feb. 26. About 162 units would be used, the estimated installation cost being $40,000 and the maintenance $13,000 per annum. In addition to this system it is planned to use a flood-lighting scheme on the large dome of the city hall, to be accomplished by placing in circular arrangement around the dome a battery of 500-watt incandescent projectors.

Opportunity Given New York Commission Staff to Attend Military Encampment.—The Public Service Commission for the First District of New York has adopted a rule which will permit its employees to attend military encampments next summer without loss of pay. Each employee is entitled to two weeks' vacation and certain additional time for other purposes. The new rule allows sixty-six hours of additional time, which, with the usual vacation allowance, will practically give a man four weeks altogether. This extra allowance, however, will be made only upon the filing of a certificate of attendance at a military camp. No deduction will be made from the pay of employees attending such camps.

Two Utah Municipal Plants Go Out of Business.—Two municipalities in the State of Utah have recently voted to sell their municipal plants and go out of the business of furnishing electricity for lighting and power purposes. In both cases the systems were purchased by the Utah Power & Light Company, and contracts have been made with that company for service for the two cities. The first city to take this step was Wellsville. Owing to the limited field open for the sale of power and the overhead expenses attending upon the operation of the small system, the operation of this municipal plant had proved to be unprofitable for some time. The second municipal plant to go out of commission was owned by the city of Farmington.

Property Owners May Cut Anchor Wires and Be Immune from Arrest.—City Manager Ward, of Sandusky, Ohio, has decided that public service companies have no right to stretch anchor wires from the tops of poles to the ground and, as a result, has instructed the police department to make no arrests where citizens cut wires stretched from poles in front of their homes. The various companies are protesting against the decision.

To Hold Examination for Electrical Trade Investigators.—The Bureau of Foreign and Domestic Commerce plans to hold an examination during the month of May for the position of special agent to investigate the markets of China, India, East Indies, Africa and Australasia for electrical goods. Application to take this examination should be made direct to the Bureau of Foreign and Domestic Commerce, Washington, D. C., and should set forth the applicant's education and his experience in the subject of the investigation.

Columbus Company Will Build Walls of New Plant in Way to Aid Flood Prevention.—In applying to the City Council of Columbus, Ohio, for permission to erect a new power plant on land it owns on the bank of the Scioto River, the Columbus Railway, Power & Light Company has offered to build its east wall 50 ft. back from the river bank to allow for condemnation of the land when the proposed flood prevention plan is put into operation and to so construct this wall that it will afford adequate protection from high water. The new plant will cost approximately $375,000 and will be equipped with a turbine of 15,000-kw. capacity in the beginning, with space for additional machines when needed. Julius F. Stone, of the conservancy commission, informed the City Council that the company's proposition would fit into the flood protection plans and appeared satisfactory in every way.

Los Angeles Loses Levining Creek Power Rights.—The California Water Commission has issued formal notice to the Public Service Commission of Los Angeles that it has granted to the Pacific Power Corporation, a subsidiary of the Nevada-California Power Company, a power permit on Levining Creek, providing for the appropriation of 40 cu. ft. per second of the creek's water for power purposes. The city made strong objection to the granting of the permit, as it interferes with the plans for further development of the municipal power project, but the protest was denied on the grounds of priority in filing the application by the power company. The power company has also been granted a power permit on Rush Creek, provided its power plant is placed at some point above that where the city proposes to construct a tunnel for the purpose of taking waters of Rush Creek through the hills and emptying them into Owens River. While this stipulation will save to the city the use of Rush Creek, the city will lose altogether its projected use of Levining Creek, it is stated, unless it purchases the installations made by the company.

Texas Electrical Contractors.—The annual meeting of the Electrical Contractors of Texas will be held in Galveston on May 17 and 18 at the same time as the meeting of the Southwestern Electrical & Gas Association.

National Fire Protection Association.—The report of the electrical committee of the National Fire Protection Association, of which F. E. Cabot of Boston is chairman and Ralph Sweetland, also of Boston, is secretary, will be given at the morning session of the second day of the twentieth annual meeting of the association which is to be held in Insurance Exchange Building, Chicago, on May 9, 10 and 11.

Electrical Development and Jovian League of San Francisco.—At a meeting of the Electrical Development and Jovian League of San Francisco, on April 26, consideration was given to the proposed new constitution. As it was felt that the league has outgrown to a great extent its present constitution and by-laws, the executive committee adopted a new constitution. Provision is made for an associate non-active membership for members of the national Jovian Order who are not affiliated with the local league as active members.

Electric Power Club.—The sixth annual meeting of the Electric Power Club will be held at Hot Springs, Va., on May 1, 2, 3 and 4 at the Homestead Hotel. Monday afternoon, May 1, part of Monday evening and Tuesday evening will be given over to committee meetings. General meetings, at which will be given the reports of the various committees, will be held on Monday morning, Monday evening, Tuesday morning, Wednesday afternoon and Thursday morning. Charles Robbins will read a paper on "Motor Ratings" at the general session on Monday evening.

New York Jovian League.—James H. McGraw, president of the McGraw Publishing Company, publisher of the ELECTRICAL WORLD, addressed the regular meeting of the Jovian League of New York City on April 26 on the subject "The Mission of a Business Paper and the Resources Necessary to Make the Paper Effective." In addition to citing some figures showing the labor, costs and capital necessary to make a business paper effective, Mr. McGraw pointed out with great emphasis that the salvation of the general magazine is in following up the lead of the business paper with articles of a broad business character.

National Association of Manufacturers.—The annual meeting of the National Association of Manufacturers will be held at the Waldorf-Astoria, New York City, on May 15, 16 and 17. On May 16, representatives of twenty-one state associations will discuss local industrial conditions in fifteen-minute talks. The next day representatives of twenty-one national craft associations will be heard in a series of brief addresses on topics of trade importance and likewise public interest. Export trade will be featured in an elaborate round-table discussion on the evening of May 16, participated in by experts in foreign trade and presided over by a trade leader of high standing. Incidental to the convention there will be an exhibition devoted to various phases of export trade.

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next-to-last text page.

Southwestern Electrical and Gas Association.—The twelfth annual convention of the Southwestern Electrical & Gas Association will be held at the Hotel Galvez, Galveston, Tex., on May 17, 18, 19 and 20. In the light and power sessions the papers will be devoted to "Rates" and "Power Load." The subject of "Rates" will be handled in all its phases by over a dozen operators of central stations—large and small—of the State, as a symposium of their experiences and opinions. In the general sessions addresses will be made by invited guests, prominent men in the industry, on "Public Policy," "Public Relations" and other similar broad subjects. The local Jovians will hold a rejuvenation and joviation during the convention.

Engineers' Society of Western Pennsylvania.—A course of five free lectures on military engineering will be given each Wednesday evening in May, starting on May 3, by Lieut.-Col. F. R. Shunk, Maj. P. S. Bond, Maj. J. C. Oakes and Capt. C. L. Sturdevant, all of the corps of engineers of the United States Army, and A. L. Humphrey, vice-president of the Westinghouse Air-brake Company, at Carnegie Music Hall, Pittsburgh, under the auspices of the Engineers' Society of Western Pennsylvania. The course will be open to all engineers and technical men or men of engineering or technical experience. Mr. Humphrey's lecture is scheduled for May 31 and his subject will be "Mobilization of Material and Industrial Resources."

Iowa Section, N. E. L. A.—A joint convention of the Iowa District Gas Association, the Iowa Street & Interurban Railway Association, and the Iowa section of the National Electric Light Association will be held at Dubuque, May 10, 11 and 12. This will be the first attempt that has been made in Iowa to bring the public utility companies comprising the railway, gas and electrical associations together. The program has been arranged in such a manner that the three associations will come together in certain joint sessions while there will also be separate sessions for the several associations. In this way it is felt that each association will retain its entire individuality, at the same time permitting of joint sessions, at which topics of interest to all can be considered. After a thorough investigation the committee on manufacturers' exhibits found that there were not a sufficient number of manufacturers interested to warrant the holding of a regular exhibit, and for that reason an exhibit, as an association proposition, has been abandoned. The program in which the National Electric Light Association section will participate is as follows: Wednesday morning, May 10, joint session, address of welcome by Hon. James Saul, Mayor of Dubuque, and an address on "Theory of Public Utility Franchises," by George McLean, president of the Key City Gas Company, Dubuque, followed by discussion; Thursday morning, May 11, joint session, to be addressed by Samuel Insull, president of the Commonwealth Edison Company, Chicago, Ill., on "Some Comments on Public Utility Commissions and Their Relations with Public Utility Companies," followed by discussion; afternoon of May 11, joint session, to consider the subject of depreciation, on which a paper will be presented by Gen. George H. Harries, president Omaha (Neb.) Electric Light & Power Company. The separate sessions of the section will begin on the afternoon of May 10, with an address by President E. M. Walker, followed by a report of the secretary-treasurer, secretary's report on membership, report of program committee, appointment of convention committees, committee report on "Telephone Interference" by J. M. Drabelle, of Cedar Rapids, a committee report on public relations by H. C. Blackwell, of Davenport, and the report of the special accounting committee by C. E. Fahrney, of Ottumwa. At the session on the morning of May 12, Dr. L. A. Hawkins, of the research laboratory of the General Electric Company of Schenectady, N. Y., will deliver an address entitled "Results of Increased Knowledge of the Nature of Electricity." It will be followed by a committee report on the "Possibilities of Business from Rural Transmission Lines," presented by W. H. Burtis, of Decorah, a committee report on "Fire Insurance Rates as Affected by the New Law," presented by J. P. Ingle, of Keokuk, and a committee report on "Draft of Recommended Ordinance Regulating Electrical Construction in the Smaller Towns," presented by M. G. Lyon, of Perry. The final separate session of the section will be held during the afternoon of May 12 and will be opened by the committee report on "Facts and Factors," by Austin Burt, of Waterloo. This will be followed by the committee report on "Collection and Compilation of Rates Charged Municipalities for Street Lighting and Water Pumping," presented by Edward Soukup, of Cedar Rapids, a committee report on "Draft of Model Contract Between Municipality and Central Station Covering Street Lighting," by Rufus E. Lee, of Clarinda, and concluding with the report of the convention committee. Separate sessions of the gas association and the railway association will be held paralleling the N. E. L. A. sessions. Entertainment features have been provided for the evenings in addition to which the Jovians will hold a rejuvenation on the evening of the second day of the convention.

FINANCE, COMMERCE AND INDUSTRY

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Electric Range Business Receives Impetus

Estimates for $1,000,000 Business in 1916 Now Thought to Be Conservative—Market Spreads Over Entire Country

The sale of electric ranges is forging ahead rapidly and bids fair to increase even more rapidly in the near future The electrical industry has been preparing for such a condition for some time, and is now in a position to handle the business with a confidence in the ultimate success of electric cooking. In anticipation of a more widespread movement to "cook by wire," rates for this class of business have been made sufficiently low that by careful and thoughtful manipulation the operating cost of the electric range is on a par with the cost of cooking with artificial gas. Data collected by the Society for Electrical Development show 2800 communities in the United States and Canada where a rate of 5 cents per kilowatt-hour or less is offered for electric cooking.

Recent developments show this movement to be gaining in momentum every day. The latest activity is the proposed National Electric Range Campaign to be promoted by the Society for Electrical Development in co-operation with range manufacturers and retail distributors.

A TRAIN LOAD OF ELECTRIC RANGES VALUED AT $53,000 FOR SALT LAKE CITY

Manufacturers of gas and coal ranges foreseeing the possibilities in the electric range have installed electric range departments in their factories and are preparing to make extensive efforts to promote electric range sales.

Nor is electric cooking devoted to a single section of the United States—it is nationwide. While of course the greatest activity is at present taking place on the Pacific Coast and in the Rocky Mountain region there is a large volume of business in the East, especially in the largest cities. Electric cooking for apartment houses is becoming very popular, and with a greater activity in building, which is expected to follow this industrial boom, it is felt that the volume of electric range orders for apartment houses will be many times larger than ever before.

In the Far West every effort is being bent to promote the sale of electric ranges. Manufacturers and central stations are co-operating to the fullest degree and are confident that the results and volume of sales will more than justify the money and energy employed in developing this market.

An estimate in the ELECTRICAL WORLD for Jan. 8, based on the opinion of those most experienced in the field, placed the probable business in electric ranges for 1916 at manufacturers' prices as $1,000,000. That was almost three months ago, and it is now probable that the estimate is far too conservative.

In the four months, October to January last, the number of electric ranges in service in Boston was almost doubled, 211 having been sold in that period. In a territory in Northern Illinois embracing 18,614 inhabitants and with 4133 electric customers, 160 electric ranges were sold from March 3 to April 20 last. It was brought out at a meeting of the electric range committee of the National Electric Light Association on Feb. 7 that indications point to the sale of 10,000 electric ranges in the Pacific and Mountain states during 1916. These are only examples, but they serve to indicate the scope of the market both in territory and in volume of purchasing.

The movement is not only a wide one, but it is a huge one. Orders are coming in to manufacturers not for single ranges, but for carload lots. As an example there is pictured on this page a trainload of electric ranges bound for Salt Lake City from the Pittsfield plant of the General Electric Company. This is a single order. The shipment contained 90 apartment type ranges, 105 ranges for domestic use, 416 of assorted types. This is a total of 611 ranges, with a listed value of approximately $53,000.

Motor Sales Still Increasing

Bookings for electric motors still increase in spite of the fact that the present motor market is unprecedented for volume. Up to the end of 1915 the demand was greatest for small industrial motors, but since that time every size, from the smallest to the largest, has been in active demand. Marked activity has been noticed in the last quarter in sales of large motors for use particularly in steel rolling mills. In January the contract was signed for a 15,000-hp. motor for the Inland Steel Company, and also for two 8000-hp. motors.

So great, in fact, has the volume of orders become that manufacturers are beginning to show signs of fear. In a few weeks the shops, which for so long had been on part time and with a greatly curtailed force of employees, were working at top speed, so sudden was the demand for electric motors. The conditions that obtained for many months had changed so suddenly and unexpectedly that many manufacturers were found unprepared in their supply of raw materials. Orders were given for raw materials, but as manufacturers did not foresee the limits to which the buying would go before the market was supplied, the supplies of copper, castings, etc., were insufficient. Since this unprecedented market first opened the distributors of raw materials have, in turn, been so swamped with orders from every direction that deliveries of castings, for instance, that ordinarily would take a few weeks, now can be obtained only by waiting until the summer of 1917, unless the buyer is willing to pay a heavy premium. The manufacturer thus finds himself in the position of a hunter suddenly brought face to face with an extraordinarily fine buck, only to find his ammunition all used up—plenty of orders, excellent credit, but no raw products, and without a definite knowledge of when they may be had.

Deliveries and prices, therefore, are very uncertain. It is practically impossible, for the reasons above stated, in regard to raw materials to guarantee definite deliveries for any near date, but the manufacturers are doing everything in their power to make them as quickly as possible and to prevent delays. Prices were advanced as the prices of materials rose, and any further advances in steel and copper will undoubtedly be reflected by further advances in motor prices.

Other production costs have advanced materially, principal among which is the cost of labor. Skilled labor is so much in demand in industrial establishments owing to the existing business boom that higher wages are everywhere

in evidence. Labor, especially skilled labor, is scarce, and in order to get it and hold it increased wages must be paid.

As to how long this voluminous buying will keep up no one is willing to hazard a guess, but it certainly is not normal, and must sooner or later drop. How it will drop off is another question. In certain quarters it is expected that the buying will drop off far more quickly than it picked up last fall. These manufacturers expect to see the booking curve rise to a peak and then take an abrupt drop. This, of course, it is pointed out, will not hurt the manufacturers from a production standpoint for two reasons: First, the manufacturers have booked up orders so far in the future that, in some cases, the factories could be kept running well up into the middle of 1917 provided they do not get another order, and second, opportunity is needed by motor manufacturers to replenish an almost thoroughly depleted stock.

Other manufacturers, on the other hand, have expressed the idea that sales will come to a peak, stay there for a while and gradually fall off until a more normal scale of purchasing takes place.

New York's Industrial Accidents Over 600 per Day

During the eighteen months ended Jan. 1, 1916, 337,500 industrial accidents, or an average of more than 600 per day, were reported to the Workmen's Compensation Bureau of New York, resulting in 56,374 cases in which claimants were entitled to disability awards of two-thirds of wages during disability above two weeks' duration, according to the report just made to the New York State Industrial Commission. The law provides no compensation for the first two weeks, except medical aid. Thus approximately 17 per cent of industrial accidents result in allowable claims for disability, and presumably all of them require medical aid.

Of the number of claims filed 1214 were death cases. In 81 per cent of the death cases there were dependents. In such cases the widow receives 30 per cent of the weekly wages of the husband during her life, unless she remarries, and the children receive 10 per cent each until the age of eighteen. If both parents are dead the children receive 15 per cent each. In 9 per cent of the death cases there were alien dependents.

A statistical analysis of the first 30,000 claims shows: Average value of awards (exclusive of medical), $157.20: average value of death awards (exclusive of medical). $3,240.72; average value of permanent total disability awards (exclusive of medical), $7,475.12; average value of permanent partial disability awards (exclusive of medical), $520.38; average value of temporary total disability (exclusive of medical), $42.41; percentage of the cost of death awards to the entire compensation cost, 41.90; of permanent total disability, 2.30; of permanent partial disability, 23.14; of temporary total disability, 24. The temporary total disability cases are the greatest in number, comprising 88.5 per cent of all cases filed. Average medical cost per reportable injury is about $10.95.

An approximation may be made of the annual distribution of benefits under the compensation law as follows: For disability and death awards, $6,507,245; for medical attendance, $2,463,750; total, $8,970,995.

Export Trade Situation

American manufactures exported from the port of New York during the week ended April 15, 1916, as compiled by the foreign trade department of the National City Bank of New York, totaled $60,142,985. In the corresponding week in 1915 the exports from this port amounted to $20,565,585 and for the corresponding week of 1914 the exports were $16,043,511. Compared with the corresponding week of 1914 the principal increases in the exports for the second week in April, 1916, occurred in commercial automobiles, explosives of all kinds, metal-working machinery, brass manufactures, iron and steel manufactures, illuminating oil, naphtha oil and sugar.

There was billed to France from the port of New York during the week ended April 15, 1916, American goods to the total of $17,916,264 as compared with the corresponding week in 1915 and 1914, for which the respective totals were $3,030,594 and $1,296,023. The exports to Austria-Hungary, Belgium and Germany were nil during the second week in April, 1916, and also in 1915, with the exception of Germany, to which in that time were exported goods to a total value of $450. For the second week in April, 1914, however, the exports to these countries amounted to $349,211 to Austria-Hungary, $4,628 to Belgium and $1,037,393 to Germany.

Comparative figures for the exports during the second week in April to England for 1916, 1915 and 1914, respectively, are $21,711,071, $4,438,369, $2,223,637.

The trade with North and Central America continues to show more gratifying totals. To South America the exports for the week ended April 15, 1916, were $3,264,235 as compared with $1,173,191 and $1,169,011 for the corresponding weeks of 1915 and 1914 respectively. Exports to the principal Latin countries of North America, namely, Cuba, Hayti, Mexico, Panama and Santo Domingo, were $2,601,325 during the week ended April 15, 1916, as compared with the corresponding week of 1915 and 1914 respectively of $1,559,815 and $1,484,590.

Exports of electrical machinery during the second week in April amounted to $309,264 as compared with $130,652 for the corresponding week in 1914. These figures are comparable to the exports for the previous week, which were shown in the ELECTRICAL WORLD of last week to have been $289,436 during the first week in April, 1916, and $169,374 during the corresponding week in 1914.

Growing Demand for Wood Poles

On the whole there is now and has been for the last few months a healthy and growing demand for wood poles for both light and power service and telephone service. This condition has not been felt by all distributors of poles, some firms still noting the depression that has been prevalent in this line for some time. In fact, up to recently for the past two or three years pole merchants have felt the call for their products to have been considerably below normal. There are a number of reasons for this condition, probably the most prominent of which are, first, the curtailment on the part of the public utilities with wire transmission systems of development and extension work; second, the growing use of ornamental metal standards for street lighting replacing former wooden poles; third, growing civic pride demanding either underground distribution within the city limits or at least a joint use of poles by the different wire transmission utilities and the abolition of separate pole systems; fourth, the polcy of the American Telephone & Telegraph Company to place long distance telephone cables underground when conditions warrant it so as to prevent a recurrence of the conditions that obtained at the Taft inauguration when Washington was practically isolated from the world because of the blizzard, and fifth, the increasing use of concrete and steel constructed poles and towers for long distance transmission work. Many other reasons could be cited, almost all of which find their inception in the progress of scientific investigation and engineering progress.

Lumber men, dealing in poles, however, find in the present conditions a new opportunity. The light and power field even at its worst enjoyed a better business than in previous years; the railway industry apparently has reached the end of its long slump and is now rapidly on the gain. Therefore, it is argued, new line construction work and betterments must be made. Because of market conditions it is felt that steel construction work will in many cases have to give way to wood. The inquiries and growing volume of orders undoubtedly justify these presumptions.

On the other hand, the pole business is retarded to an appreciable extent because of the inability to get prompt deliveries of the material and because of the increased cost of line material, principally copper. Were deliveries not so long and were prices more nearly normal the lumbermen feel that the demand for wood poles would be much greater.

The feeling in this industry is, generally speaking, very optimistic. Good business is expected for some time, and

the present volume of buying, it is thought, is but an indication of greater activity in this line.

A note of warning, however, is sounded by the lumber industry. Stocks are never very large and for the past couple of seasons have been far below normal. Not anticipating this present market and believing that the depression of past years was in no way abated, coupled with the heavy snows in the northern lumber tracts, the timber cut for pole purposes was decidedly small. In view of the increasing buying the supply, therefore, is limited.

Prices have advanced generally, and further advances, it is thought, can be expected, although there are some lumbermen whose quotations have not changed. Where prices have gone up it has been pointed out that the greater difficulty of getting the poles out of the woods this year, increased cost of labor and materials and other production costs, small amount of stock cut and the economic condition of the market are responsible. Higher prices generally for lumber, increased demand for poles and increased exports are a few of these economic factors that are making for higher prices.

Deliveries are dependent upon railroad facilities. Shortage of freight cars is apparently the only serious drawback to immediate shipments of orders. The congestion of freight at Eastern terminals resulting in freight embargoes to these centers has caused delays that otherwise would not have happened. It is universally felt that in this class of business credits and collections are excellent. In fact, they never have been a cause for worry on the part of pole distributors. Those who purchase poles are in a financially responsible class.

Labor Unrest Spreads to Electrical Factories

As indicative of the unrest of labor, strikes have occurred during the past week or so in the shops of three prominent manufacturers of electrical products. That this labor disturbance will spread and become general is perhaps not unexpected since the natural desire to share in what appears to be increased profits is strong and the labor agitator has a special opportunity to take advantage of the situation.

A week ago Friday a strike was inaugurated at the shops of the Westinghouse Electric & Manufacturing Company which has grown until at the time of going to press the plants of the company were shut down with something like 15,000 men out of work. No formal demands, Chairman Guy E. Tripp said in a statement on Saturday last, were made on the company by the striking employees, although it is understood that the men desired an eight-hour day with an increase in wages. Only last December the company made an advance in wages of 10 per cent. The men now working on a 56-hours a week schedule, it is said, want the 48-hour schedule at the same wages as for 56 hours.

The Westinghouse works of the Pittsburgh district are known to be committed as opposed to the reduction of working hours at the present time.

Following rioting early in the week, the managers of the Westinghouse Airbrake Company and of the Union Switch & Signal Company closed down their plants on Wednesday, owing to their inability to protect their employees from violence offered by the strikers.

Striking employees of the National Conduit & Cable Company at Hastings-on-Hudson, N. Y., caused the company to completely shut down the plant during the week, but a settlement was effected whereby the men returned to work Thursday. The company employs in the neighborhood of 3000 persons. The strikers demanded a 50-hour week instead of one of 54 hours and an increase of 5 cents per hour in wages. The strikers, after being out a few days, accepted the company's offer of an increase of 2 cents an hour in wages.

On April 21, 250 of the 1500 employees of the Habirshaw Wire Company, at Yonkers, N. Y., struck in sympathy with the conduit concern's employees. The men demanded $2 a day instead of $1.50. A few days later, however, on receipt of their pay envelopes, the men found 20 per cent more than was expected. The company stated that this action had been decided on some time ago to go into effect this week.

A number of other strikes are in progress in other industries, the demands being generally for an eight-hour day at the same weekly wage as formerly.

At Pittsburgh, 24,000 miners employed by the Pittsburgh Coal Company are on strike and more than 50,000 workmen of about thirty smaller manufacturing plants are idle because their demands for an eight-hour day and better working conditions have not been granted.

Seventy-five manufacturers, many of whom have strikes on at present, signed an agreement this week not to grant a reduction of working hours. Most of the men are working nine and a half hours.

The Department of Labor is sending additional conciliators to the Pittsburgh district to try to settle the strikes now in progress there. Administration officials are seriously concerned over the increasing labor unrest reported from every section of the country. Many plants are threatened with strikes as a result of demands by employees for shorter working hours and more pay, and Secretary of Labor Wilson has instructed all of his agents everywhere to report full details to Washington so that, if possible, steps can be taken to prevent these strikes before they become general.

While the present move of the labor unions, in view of the almost unprecedented industrial activity, would seem to have wonderful strategic possibilities, it is probable that the leaders have overlooked the conditions that now obtain in the market for raw materials. Deliveries have become so scheduled owing to the scarcity of raw material and freight congestion that a strike of limited duration probably will not materially affect delivery dates now promised.

Manufacturing and Industrial

The Ridgway Dynamo & Engine Company, Ridgway, Pa., has recently moved its Boston office to Room 420, Exchange Building, which will be under the management of A. R. Meek.

Norton, Bird & Whitman.—Ezra B. Whitman has joined the firm of Norton & Bird, engineers, Munsey Building, Baltimore, Md., and the firm's name will now be Norton, Bird & Whitman.

The I. P. Morris Company, Philadelphia, Pa., has just received a contract from the Mattagami Pulp & Paper Company, Toronto, Canada, for two 4500-hp. vertical-shaft, single-runner turbines to operate under a head of 45 ft. An additional unit will later be installed in this plant.

Williams, Bradbury & See.—Lynn A. Williams and Clifford C. Bradbury announce that Robert M. See, formerly with Fay & Oberlin of Cleveland and Parkinson & Lane of Chicago, has become a member of their firm, and that the firm name has been changed from Williams & Bradbury to Williams, Bradbury & See. About May 1 the offices of the firm will be moved from Room 719 to Room 1312 Monadnock Block, Chicago, where the practice of patent, trademark and copyright law will be continued.

Rutenber Electric Company.—The Rutenber Electric Company which is now located at Logansport, Ind., will move its factory to Marion, Ind., within the next ninety days. At Marion a new brick and structural steel fireproof plant with 15,000 sq. ft. of floor space is to be erected. The Rutenber Electric Company is capitalized at $200,000 and $50,000 worth of this stock has been taken by Marion people. The plant will empoy seventy-five men, and will continue to engage in the production of electric ranges.

Electric-Vehicle Exhibition in Connection With N. E. L. A. Convention.—An interesting display of various types of commercial and pleasure electric cars, batteries, charging apparatus, etc., will be made at the Auditorium Theater, Chicago, at the time the National Electric Light Association meets for its thirty-ninth annual convention, May 22-26. The floor plan, giving all details in connection with the exhibits, shows some fifty-three booths, with an aggregate floor area of 10,550 sy. ft. of space for exhibition

purposes. Manufacturers will begin installing their exhibits, May 22, at 8 o'clock a. m., all work and details of the display to be completed by 8 a. m. the following day.

NEW YORK METAL MARKET PRICES

	April 18 Selling Prices Bid	Asked	April 25 Selling Prices Bid	Asked
Copper	£ s d		£ s d	
London, standard spot	128 0 0		131 0 0	
Prime Lake	29.00 to 29.50†		29.50	to 30.00†
Electrolytic	29.50 to 30.00†		30.00	to 31.00†
Casting	27.25 to 27.75†		27.50	to 28.00†
Copper wire base	31.50 to 32.00†		32.50	to 33.50†
Lead	7.50		7.50	
Nickel	45.00 to 50.00		45.00	to 50.00
Sheet zinc, f.o.b. smelter	25.00†		25.50†	
Spelter	19.05 to 19.30†		18.17½	to 18.42½†
Tin, Straits	51.50†		49.50†	
Aluminum, 98 to 99 per cent.	57.00 to 59.00†		57.00	to 59.00†

OLD METALS

Heavy copper and wire	23.00 to 23.50†	23.00	to 23.50†
Brass, heavy	14.50 to 15.00†	14.75	to 15.25†
Brass, light	11.75 to 12.00†	11.75	to 12.00†
Lead, heavy	6.40 to 6.62½†	6.40	to 6.62½†
Zinc, new scrap	16.50 to 17.25†	16.00	to 17.00†

COPPER EXPORTS

Total tons to April 25	18,780

†Nominal.

Corporate and Financial

American Power & Light Company, New York, N. Y.—With the proceeds so far received from the sale of gold debenture bonds, American 6 per cent issue, recently offered to its stockholders the company has anticipated payment of the $3,000,000 one-year 6 per cent notes, which were due on July 13, 1916, and has liquidated all other floating indebtedness. The proceeds from the sale of additional bonds will be used for working capital. As of March 31, 1916, the company had total current assets of $1,841,113 (of which $288,212 was cash) and current liabilities of only $193,930. All floating indebtedness (except the usual current accounts, which are more than offset by current accounts receivable) of the company's subsidiaries is all owing to the company.

American Railways Company, Philadelphia, Pa.—The business depression which was general throughout the country, it is stated in the annual report for 1915, was reflected in the earnings of the various subsidiary companies for several months beginning with April, 1915, but conditions improved materially in the last few months of the year.

The combined income statement of the subsidiary and affiliated companies for the fiscal year ended Dec. 31, 1915, follows:

Operating revenues		$5,438,247
Operating expenses, including depreciation reserves		3,209,764
Net revenue		$2,228,483
Taxes		285,705
Operating income		$1,942,778
Non-operating income		53,441
Gross income		$1,996,219
Interest deductions, rentals amortization of discount on funded debt and other charges	$896,399	
Sinking fund deduction	26,242	
		922,641
*Net income for the year		$1,073,578

*Includes income received by the American Railways Company and the balance transferred to the profit and loss account of the subsidiary companies after payment of dividends to outside ownership.

British Westinghouse Electric & Manufacturing Company—The results of the company's operation for 1914 and 1915 are shown in the following table:

	1914	1915
Gross profits	$1,339,095	$1,469,945
Interest	348,270	348,270
Expenses on surplus bonds, etc	14,110	16,180
Depreciation	218,580	221,735
Net profit	$758,135	$883,760
Preferred stock dividend	375,000	375,000
To reserve, etc.	375,000	326,205
Balance	$8,135	$182,555
Brought forward	32,470	40,605
Carried forward	$40,605	$233,160

Choctaw Railway & Lighting Company, McAlester, Okla.—The company has just been sold to C. M. Mason of New York, chairman of the bondholders' protective committee, for $450,000. The plant will be equipped with new machinery and improved in other respects.

Dayton (Ohio) Power & Light Company—During the first quarter of 1916 the company has been making enormous strides in its earnings. The gross earnings for the first three months of 1916 were 47 per cent greater than for the corresponding period in 1915, while the March gross was 56 per cent larger than that for March, 1915. The net income for March, 1916, after deducting interest and sinking fund, was 142 per cent greater than that for the previous March. Although the dividends apportioned to March, 1916, are 42 per cent greater than for the previous March, the surplus for the month was 254 per cent greater than for March of last year.

Hortonia Power Company, Rutland, Vt.—A block of $250,000 of first mortgage 5 per cent bonds due on Feb. 1, 1945, is being offered at 92.5 and interest.

International Steam Pump Company.—The Worthington Pump & Machinery Corporation, recently organized under the laws of Virginia, was this week declared the successor in ownership of the properties of the defunct International Steam Pump Company, the plan of the joint reorganization committee having become effective. Securities of the new company can now be exchanged for certificates of deposit of securities in the old. The new company has acquired direct ownership of the properties owned by the old company and its subsidiaries with the exception of Henry R. Worthington, in which it owns practically all of the common and more than 95 per cent of the preferred. Its only outstanding liens are $200,000 5 per cent. bonds of the Jeanesville Iron Works and $423,400 5 per cent bonds of the Holly Manufacturing Company. It will start business with $3,093,000 cash. All of the new company's stock has been placed under a voting trust, to continue for five years from April 1, 1916.

Northern States Power Company, Chicago, Ill.—An issue of $18,000,000 of first and refunding mortgage 5 per cent bonds due April 1, 1941, is being offered at 96.5 and interest. This issue completes the financing of the consolidation of the subsidiary companies' securities and its securities, as explained in the ELECTRICAL WORLD for April 15.

Olympic Power Company, Port Angeles, Wash.—Judge Ralston, in the Clallam County Superior Court, recently discharged the receiver appointed some months ago for the company as a further step in the reorganization proceedings. The new company, the Northwestern Power & Manufacturing Company, will take over the assets and liabilities of the Olympic Power Company, the stockholders in which will take preferred stock in the new company, in exchange for their old holdings. For the present the business conducted by the Olympic company will be transacted under its old name. There will be no change in the local management for the time being.

Pacific Gas & Electric Company, San Francisco, Cal.—At the recent annual meeting of the company, Samuel Insull of Chicago retired as a director of the organization and was succeeded by Norman Livingston of San Francisco.

St. Lawrence Transmission Company, Hannawa Falls, N. Y.—The Public Service Commission of the Second District of New York has approved the consolidation of the St. Lawrence Transmission Company and the Northern Power Company, all of the capital stock of both companies being owned by the St. Lawrence River Power Company. The Transmission company obtains all its power by purchase from the Hannawa Falls Water Power Company, the Cedar Rapids Transmission Company and the St. Lawrence River Power Company. Its capital stock, all common, is $10,000. The Northern Power Company is capitalized at $316,000, and buys all its power from either the Hannawa Falls Water Power Company or the Snell Power Company. Upon the consolidation the company will be called the St. Lawrence Transmission Company and will be capitalized at $525,000. It is only proposed at this time, however, and the commission only permits the new company to issue $326,000 in stock, which will be exchanged share for share at par for the outstanding stock of the present companies.

The Lorain County Electric Company, Elyria, Ohio—The company announces that it has purchased the electric properties of the Ely Realty Company, the Elyria Milling & Power Company and the Citizens Gas & Electric Company, all of Elyria, Ohio.

Toledo (Ohio) Railways & Light Company, Toledo, Ohio—The committee appointed by Mayor Milroy has reported the formation of a plan which contemplates the transfer of the street railway property, exclusive of the power plant and electric distributing system, by the Toledo Railways & Light Company, to a new corporation, to be called the Community Traction Company. The Toledo company will receive in exchange stock of the new company in the amount of the arbitrated value of the property so transferred. No bonds will be issued by the Community Traction Company, and the money necessary for extensions and betterments to the property is to be advanced by the Toledo Railways & Light Company in exchange for an equal amount of stock, the latter to be subject to the same provisions as apply to the original stock. The present operating company is to retain its power house and all of its light and power business, and the Community Traction Company will become its customer for energy at wholesale.

United Gas & Electric Corporation, New York, N. Y.—The annual report of the company for the year ended Dec. 31, 1915, shows a balance of surplus of $645,384, as compared with the balance on Jan. 1, 1915, of $498,090. The comparative results of operation of the subsidiary companies for the years ended Dec. 31, 1914 and 1915, follow:

	1915	1914
Gross earnings	$13,564,411	$13,129,133
Operating expenses including maintenance	6,836,119	6,912,294
Net income	$6,728,292	$6,216,839
Taxes	821,429	761,050
Gross corporate income	$5,906,863	$5,455,789
Fixed charges	3,419,897	3,344,298
Balance available for renewals, financing and dividends	$2,486,966	$2,111,491

New Utility and Industrial Companies

The Eastern Electric Company of Hartford, Conn., has been incorporated with a capital stock of $1,000 by Stanley H. Davis, Abraham N. Davis and Max Davis.

The Kenedy Light & Power Company of Kenedy, Tex., has been incorporated by E. B. Fehrenkamp, Fred Fehrenkamp and M. A. Naescher. Capital stock, $10,000.

The W. E. House Electric Company of Hartford, Conn., has been chartered with a capital stock of $50,000. The incorporators are: W. E. House, H. M. Scofield, H. F. House, E. M. Young and C. B. Connor.

The Southern New England Power Company of Hartford, Conn., has been incorporated with a capital stock of $2,000. The officers are E. H. McHenry, president; H. S. Platt, secretary and treasurer, and H. V. Donlon, director.

The Power Efficiency Corporation of Buffalo, N. Y., has been incorporated with a capital stock of $25,000 by E. M. Hill, A. T. and H. B. Spaulding. The company is capitalized at $25,000 and proposes to do a general contracting, electrical and mechanical engineering business.

The American Heat & Power Company of Wilmington, Del., has been incorporated with a capital stock of $1,500,000 to manufacture and deal in combustion devices, furnaces, steam, ventilating specialities, etc. The incorporators are: Herbert E. Latter, Norman P. Coffin and Clemont M. Egner of Wilmington, Del.

Whiteside & Company of New York, N. Y., has been incorporated with a capital stock of $50,000 to manufacture and deal in electric motors, machines, etc., for dentists. The incorporators are: R. W. Schuette, 236 West Fifty-fourth Street; C. F. Novotny, A. A. Meschutt, 5 Nassau Street, New York, N. Y.

The Radio Engineering Company of New York, Albany, N. Y., has been incorporated by R. D. Hanna, H. and J. H. Hammond, Jr., 110 Broadway, New York, N. Y. The company is capitalized at $100,000 and proposes to manufacture and deal in electrical, magnetical, mechanical, other devices and apparatus pertaining to wireless telephony.

Trade Publications

Solder Products.—Hess & Son, Philadelphia, Pa., have issued an illustrated booklet on their "Tinol" solder products.

Store-Window Reflector.—W. R. Ostrander & Company, 22 Dey Street, New York, have issued an illustrated leaflet on their "Sunray" store-window reflector.

Used Equipment.—Archer & Baldwin, 114 Liberty Street, New York, have issued their April list of used electrical and steam machinery, power-house equipment, etc.

Electric Washer.—The Victor Manufacturing Company, Leavenworth, Kan., is sending out an illustrated folder which contains information on its electric washer with telescopic tub stand.

Light-Weight Vacuum Cleaners.—The "Pneumode" light-weight vacuum cleaner is described and illustrated in a folder issued by the Bright Circle Manufacturing Company, Toledo, Ohio.

Electric Cooking Stove.—The Caloric Company, Janesville, Wis., has issued two illustrated catalogs which contain information on its electrically operated stoves of the "fireless cooker" type.

Electrically Lighted Pad.—The Supremus Manufacturing Company, 17 Park Row, New York, has prepared several illustrated circulars containing information on an electrically illuminated pad.

A Flat-Type Dry Cell.—The Cleveland Battery & Electric Company, 1974 East Sixty-sixth Street, Cleveland, Ohio, is sending out an illustrated folder which contains information on its flat-type dry cell.

Socket Cover and Shade Holder.—The J. H. White Manufacturing Company, 111 North Third Street, Brooklyn, N. Y., has published an illustrated leaflet descriptive of its socket cover and shade holder.

High-Compression Oil Engine.—The Nordberg Manufacturing Company, Milwaukee, Wis., is giving out illustrated Bulletin No. 27A, which describes and illustrates its high-compression two-stroke-cycle oil engine.

V-Notch Recording Meter.—The Yarnall-Waring Company, 1109 Locust Street, Philadelphia, Pa., is distributing two illustrated folders which contain information on and illustrations of its "Lea" V-notch recorder.

Directly Connected Ice-Cream Freezers.—The F. E. Whitney Company, 65 Sudbury Street, Boston, Mass., has issued an illustrated bulletin descriptive of its ice-cream freezers which are directly connected to electric motors.

Starting and Lighting Batteries.—Bulletin No. 17, recently issued by the General Lead Batteries Company, Newark, N. J., contains information on starting and lighting batteries for use with gasoline-operated cars.

Electrically Operated Ice-Cream Freezers.—The Emery Thompson Machine & Supply Company, 235 East Forty-first Street, New York, has issued two illustrated bulletins describing its electrically operated circulating-brine-base freezers.

Rotary Automatic Fire Alarm.—The Volunteer Firemen Signal Company, 119 Fifth Street, South East, Minneapolis, Minn., has prepared a bulletin which describes and illustrates its automatic fire-alarm system for use with telephone apparatus.

Electrical Supplies.—The Julius Andrae & Sons Company, Broadway and Michigan Streets, Milwaukee, Wis., has issued Catalog No. 102, which contains information on various kinds of electrical, automobile, motorcycle, gas engine and bicycle supplies.

Receptacles and Attachment Plugs.—Harvey Hubbell, Inc., Bridgeport, Conn., has prepared an illustrated folder descriptive of several types of T-slot receptacles and attachment plugs. This folder is printed in colors, and is entitled "The Bread That Comes Back Buttered."

Portable Ohmmeters.—The Roller-Smith Company, 203 Broadway, New York, has issued Bulletin No. 100 which contains information on electrical instruments for signal-system testing, including direct current and alternating current, portable voltammeters, and direct-reading portable ohmmeters.

New England

BUCKSPORT, ME.—The Penobscot Bay Electric Company of Bucksport is contemplating extending its transmission lines to Saturday Cove, Temple Heights in Northport and to Islesboro.

MILO, ME.—The Milo Electric Light & Power Company expects to purchase one 50-kva., 2300/6600-volt transformer and eighteen 2 to 5 kva., 6600/110-volt transformers; also line hardware, insulators, etc. for about 7 miles of single-phase transmission line, and 14 miles of No. 6 medium hard-drawn copper wire. C. D. Towne is manager.

SEBEC, ME.—The Milo (Me.) Electric Light & Power Company has been authorized by the Public Utilities Commission to supply electricity in Sebec.

NASHUA, N. H.—The street lighting committee has been authorized to negotiate with the Nashua Light, Heat & Power Company in regard to changing the street-lighting system. Arc lamps are now in use.

PORTSMOUTH, N. H.—Orders have been placed by the Rockingham County Light & Power Company for two Babcock & Wilcox boilers and one 625-kva. frequency changer. The company will also let contract for a 1500 or 2500-kva. 60-cycle General Electric turbine. F. A. Belden is manager.

TWIN MOUNTAIN, N. H.—A new lighting plant is to be installed at the Maples Hotel.

BARRE, VT.—The Boutwell, Milne & Varnum Company of Barre is contemplating the construction of a new power plant.

HARDWICK, VT.—The Eastern Vermont Public Utilities Corporation, recently incorporated, has applied to the Public Service Commission for permission to issue $500,000 in bonds and $100,000 in capital stock. The company owns the electric plants at Granville, N. Y., and South Ryegate, Vt., and several large water powers. F. Monroe Dyer of New York, N. Y., and I. M. Frost of Rutland are interested in the company.

BROCKTON, MASS.—Preparations are being made by the Edison Electric Illuminating Company of Brockton to enlarge its main substation on Main Street, at a cost of about $125,000. Under the new plans the present substation will be used entirely for direct-current service; all the alternating-current equipment will be moved to the old Brockton steam plant.

LOWELL, MASS.—The Lowell Electric Light Corporation has petitioned the Council for permission to lay underground conduits in Walker and West Adams Streets.

MILFORD, MASS.—The Milford Electric Light & Power Company has awarded the contract for construction of new transformer station on Pond Street to Water & Hynes.

NORTH ADAMS, MASS.—The North Adams Gas Light Company is considering further extensions to its distributing system.

PEABODY, MASS.—The citizens have authorized an appropriation of $40,000 for the purchase of additional equipment for the municipal electric-light plant. W. D. King is manager.

SALEM, MASS.—The Salem Electric Lighting Company has applied for permission to lay conduits through Chestnut and other streets.

SALEM, MASS.—The American Glue Company has awarded the contract for the construction of a new power plant at its works on Washington Street to the E. H. Porter Company.

SALEM, MASS.—The State Gas and Electric Light Commissioners have granted the Eastern Massachusetts Electric Company, recently organized, permission to issue $125,000 in capital stock, the proceeds to be used to erect and equip transmission lines from a point on Highland Avenue in the outskirts of Salem, through Peabody, Lynn, Lynnfield, Wakefield and Saugus, to a point on the Melrose-Saugus line. The new company proposes to connect the system of the Salem (Mass.) Electric Lighting Company, the Malden (Mass.) Electric Company and the Suburban Gas & Electric Company of Revere.

WESTFIELD, MASS.—The Electric Light Commissioners are planning to extend the transmission lines of the municipal electric-light plant to Middle Farms to supply electricity to the brick yards of the Westfield Clay Products Company. The cost of the extension is estimated at $12,000.

WRENTHAM, MASS.—Investigations are being made by the town of Wrentham as to the advisability of establishing a municipal plant for street-lighting.

PROVIDENCE, R. I.—A plan for lighting the State Capitol Building by the floodlight system has been proposed to the State House Commission and the Providence Chamber of Commerce.

PROVIDENCE, R. I.—The City Council has granted the Narragansett Electric Lighting Company permission to construct underground conduits in Locke Street from Charles Street to Ormsbee Avenue.

BRIDGEPORT, CONN.—Bids will be received by the Board of Contract and Supply, City Hall, Bridgeport, Conn., until May 10 for one 125-hp. uniflow steam engine directly connected to a three-phase, 60-cycle, 220-volt alternating-current generator; three 125-hp. water tube boilers with superheaters; three 150-hp. uniflow steam engines and three high speed, double-acting, horizontal ammonia compressors and appurtenances. Specifications, proposals and full information may be obtained from Fletcher-Thompson, Inc., 1089 Broad Street, Bridgeport.

MECHANICSVILLE, CONN.—Work has begun on the construction of the addition of the power house of the French River Textile Company at Mechanicsville.

WATERBURY, CONN.—Plans are being prepared for the new rolling mill (101 ft. by 160 ft.), power house (25 ft. by 80 ft.), and coal pocket to be erected on Watertown Avenue for A. H. Wells & Company. Charles H. Preston, Jr., is architect.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

Middle Atlantic

BAY SHORE, N. Y.—The Suffolk Gas & Electric Company of Bay Shore recently remodeled its switchboard and installed potential regulators and is contemplating changing 3.5 and 4-amp. series circuits to 6.6 amp. A. H. Vail is manager.

BUFFALO, N. Y.—The Public Service Commission has granted the Buffalo General Electric Company permission to issue $3,625,287 in securities, the proceeds to be used for a new steam generating station, now under construction in Tonawanda.

CANAJOHARIE, N. Y.—The Montgomery Electric Light & Power Company of Canajoharie has nearly completed an extension to Cherry Valley. W. J. Roser is manager.

COBLESKILL, N. Y.—The Courter Electric Company of Cobleskill has completed the erection of a 22,000-volt transmission line from Fort Plain to Cobleskill, 22 miles long. The local steam plant has been closed down and new substation equipment installed. Energy is purchased from the Mohawk Hydro-Electric Company of Ephratah. L. A. Raven is manager.

FORESTVILLE, N. Y.—Application has been made to the Public Service Commission by the Silver Creek Electric Company for authority to erect a transmission line in the village of Forestville.

FULTON, N. Y.—The Public Service Commission has granted the Fulton Light, Heat & Power Company permission to issue $49,000 in capital stock for improvements and extensions to its power plant and distributing system.

HANOVER, N. Y.—The Silver Creek Electric Company has applied to the Public Service Commission for permission to erect a transmission line in the town of Hanover.

HUDSON, N. Y.—The Albany Southern Railroad Company of Hudson has signed a contract to supply energy to the Chatham Electric Light & Power Company for a period of ten years. The Albany company is also negotiating with the villages of Poestenkill, Averill Park, Defreestville and other towns in the vicinity of Chatham, to furnish electrical service.

JAMESTOWN, N. Y.—Bids have been received for a 1000-kw. turbo-generator condenser and switchboard for the municipal electric-light plant. Bids were opened April 12, but contracts have not yet been awarded. C. O. Johnson is assistant superintendent.

LONG BEACH, N. Y.—The Long Beach Power Company has applied to the Public Service Commission for permission to construct an electric-light plant, conduits, etc., in the village of Long Beach.

MORRISTOWN, N. Y.—The Gregory Electric Company of Morristown is erecting a 15-mile transmission line for which most of the material has been purchased. The company has under consideration a 5-mile extension (pole construction) and also a 2-mile extension (submarine work). If this work is decided upon the contract will require conduit for high-tension line. A. W. Gregory is president.

NEW YORK, N. Y.—A new electric elevator will be installed in the Margaret Louisa Home, 14 East Sixteenth Street; also refrigerating and heating apparatus in connection with alterations to be made to the building. Charles Houghin Higgins, 30 Church Street, New York, is consulting engineer and architect.

NEW YORK, N. Y.—Bids will be received by Robert Adamson, Fire Commissioner, eleventh floor, Municipal Building, New York, until May 5, for furnishing tools, implements, hardware, electrical machinists' and engineers' supplies. Blanks and further information may be obtained at the office of the Fire Department, eleventh floor, Municipal Building.

NIAGARA FALLS, N. Y.—The Carborundum Company of Niagara Falls has purchased a site on the upper milling district from the Niagara Falls Power Company, on which it will erect a large addition to its plant.

OLD FORGE, N. Y.—The Public Service Commission has approved the franchise of the Fulton Chain Electric Company for an electric distribution system in the village of Old Forge. The company has been supplying electricity, using the municipal distributing system. Under the new agreement the company will purchase the system and will supply the service over its own lines under a ten-year franchise.

OSWEGO, N. Y.—The Peoples Gas & Electric Company expects to install two new vertical water wheels and two 200-kw. (each) generators, replacing the old water wheels and generators (belted), and to erect 4 miles of transmission line to the village of Scriba.

PARISHVILLE, N. Y.—The Parishville Electric Light & Power Company has completed its new plant. The old power house was burned down Jan. 29, 1916. The company will need transformers and some No. 8 weather-proof wire. A. N. Woodward is manager.

PERRYSBURG, N. Y.—The Silver Creek Electric Company has petitioned the Public Service Commission for permission to construct a transmission line in the town of Perrysburg.

PORT HENRY, N. Y.—The Port Henry Light, Heat & Power Company is building a new power plant, penstock and 8 miles of transmission line. All material has been purchased. George H. Barwise is secretary.

POTSDAM, N. Y.—The St. Lawrence Transmission Company, which was recently consolidated with the Northern Power Company of Potsdam will complete, this season, the erection of a steel tower transmission line from Raymondville to Massena, connecting with the line erected last year from Hanawa to Raymondville. The total distance to be erected is 25 miles. Steel towers and aluminum cables will be used.

ROCHESTER, N. Y.—Plans are being considered for the installation of a new street-lighting system on Main Street East from University Avenue to the city line.

SHERBURNE, N. Y.—Plans are being considered for the installation of a 150-hp. fire tube boiler in the municipal electric-light plant. William Chany is manager.

SKANEATELES, N. Y.—The Niagara, Lockport & Ontario Power Company of Buffalo has been authorized by the Public Service Commission to extend its transmission lines into Skaneateles, to supply energy to the municipal electric system.

WALTON, N. Y.—The Southern New York Power Company of Walton has increased its capital stock from $50,000 to $65,000.

WATERVLIET, N. Y.—The city officials are considering closing down the municipal electric plant and contracting with a private corporation for lighting the streets and public buildings of the city.

AUBURN, PA.—The Eastern Pennsylvania Light, Heat & Power Company has contracted to supply energy in Auburn from the Palo Alto plant.

BERKS, PA.—Application has been made by the Mount Aetna Electric Company of Berks to the Public Service Commission for approval of a charter to supply electricity in Berks.

CHESTER, PA.—A petition is being circulated by the business men on Baltimore Street asking for a better street-lighting system on that thoroughfare, which will be submitted to the Council.

DILLSBURG, PA.—The Dillsburg Light, Heat & Power Company is contemplating extending its transmission lines to Wellsburg, 8 miles distant, to furnish electrical service in that town.

ELLWOOD CITY, PA.—Application has been made to the Public Service Commission by the Connoquenessing Light & Heat Com-

pany for a charter to supply electricity in Ellwood City.

HALIFAX, PA.—Application will be made to the Governor of Pennsylvania on May 1 by the Halifax Electric Light, Heat & Power Company for a charter to supply electricity for lamps, heaters and motors in the borough of Halifax. H. L. Lark is solicitor.

NEW BRIGHTON, PA.—The borough of New Brighton has engaged H. O. Swoboda, consulting engineer, Empire Building, Pittsburgh, to prepare plans for a new street-lighting system for the borough.

PHOENIXVILLE, PA.—The Philadelphia Suburban Gas & Electric Company, which operates plants in West Chester, Pottstown and Phoenixville, has made Phoenixville its operating center. It is understood that the local plant will be enlarged and will supply energy to the three towns.

READING, PA.—The installation of an electric power plant at the County Home is under consideration by the County Commissioners.

BELVIDERE, N. J.—The Board of Freeholders has granted the Hackettstown (N. J.) Electric Light Company a fifty-year franchise to supply electricity in Belvidere. A franchise has also been given to George P. Williams of Great Meadows.

DOVER, N. J.—The Morris County Traction Company of Morristown is planning to install new rotary transformer equipment in its substation near Dover.

LONG BRANCH, N. J.—Plans are being considered for the installation of a new street-lighting system in the business section. Ornamental standards carrying single lamps or three-lamp clusters will be used.

NEWARK, N. J.—Paul J. Moore, chief of fire department, in a report to the Board of Public Works, recommends the installation of an underground conduit for fire alarm wires immediately.

BALTIMORE, MD.—The bill authorizing an issue of $1,000,000 in bonds for conduit for the city of Baltimore has been signed by the Governor.

BALTIMORE, MD.—The contract for installation and maintenance of fixtures for special illumination and street decorations during the Elks' Convention in July has been awarded to the National Electric Company, 613 East Lombart Street, at $11,500. W. Mohr, superintendent of lamps and lighting, will supervise the installation.

CENTREVILLE, MD.—The State Legislature has passed a bill authorizing the Town Commissioners of Centreville to borrow $8,500 for the purpose of purchasing an oil burning engine, electric generator and accessories for the municipal electric-light plant.

BLUEFIELD, W. VA.—The Appalachian Power Company of Bluefield has begun work on the erection of the extension of the main line on East Princeton Avenue from Lee Street to the county road bridge where it will connect with the Princeton-Bluefield car line. The Appalachian company has closed a contract with the Princeton-Bluefield Car Company to furnish energy to operate the railway to the county seat.

CLARKESBURG, W. VA.—The Clarkesburg Gas & Electric Company is extending its electric transmission lines to Norwood, Grasselli, Tin Plate and Owens.

WASHINGTON, D. C.—Foreign trade opportunities are announced by the Bureau of Commerce reports as follows: No. 20,760—An information bureau in India writes that it desires to receive catalogs and, if possible, samples from American manufacturers of oak-tanned leather belting, hydraulic and steam packing, cement, lubricating oils and greases, electric fans, etc. It is stated that these catalogs, etc., are desired to pass on to all leading firms in India who may require the names of manufacturers of these articles. No. 20,764—A business man from Bolivia who is new in the United States for the purpose of purchasing electrical supplies, lamps, toys, wearing apparel, etc., also desires to make agency connections. No. 20,680—An American consular officer in Norway reports that a firm in his district is in the market for magnetic chucks for surface grinders, steel cylinders, steel tubing for electric conduits, electrical cables, copper tubing, tubing endless wire nets, etc. A complete list of requirements, including specifications and full information, may be examined at the bureau or its district offices. (Refer to file No. 73,822). No. 20,697—An American consular officer in Spain writes that a man in his district desires quotations, samples and full information from American manufacturers of all kinds of chemical products for pharmaceutical and industrial use, electrical apparatus for medical purposes, including dentistry and X-ray. Correspondence should be in Spanish or French. No. 20,711—A commercial agent of the bureau reports that a representative of a European tramway system is now in the United States for the purpose of establishing commercial relations with American manufactures of all kinds of tramway and electrical machinery. No. 20,713—A commercial agent of the bureau reports that an electrical and mechanical engineer in France desires to get in touch with manufacturers in the United States with a view of representing them in France or taking charge or their factories in that country. Correspondence may be in English. No. 20,719—A commercial agent of the bureau writes that a business man from Spain is now in the United States for the purpose of establishing commercial relations with American manufacturers of electrical supplies, textile machinery, hardware, etc. No. 20,723—An American consular officer in China writes that a railway in that country is considering proposals for replacing locomotive head lights with American searchlights. No. 20,740—An American consular officer in Norway reports that a firm in his district is in the market for 100 electric pleasure and 200 electric commercial automobiles. Quotations f.o.b. New York, and catalogs should be sent. Correspondence may be in English. No. 20,751—A man in Canada desires to communicate with American manufactures of electroplating supplies. No. 20,753—An American consular officer in Peru reports that a man in his district desires to be placed in touch with American manufacturers of slot telephones for the Peruvian 5 and 10 centavo pieces. No. 20,971—A firm in Spain writes that it desires to be placed in touch with American manufacturers of electrically operated or automatic presses, glazing machinery and other appliances for making glazed wall tiles. Further information may be obtained on application to the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., or its branch offices.

North Central

BATTLE CREEK, MICH.—Preparations are under way for the construction of a new power plant at the Postum Cereal Company. The installation will be made in sections in order to maintain plant operations while new construction is going on.

CLARKSTON, MICH.—The Village Council has decided to install a street-lighting system in Clarkston.

SAGINAW, MICH.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 17 for a new boiler, etc., in the post office at Saginaw. For details see proposal columns.

ALLIANCE, OHIO.—Plans are being considered by the City Council for equipping the old sewage disposal works as an electrical plant to supply electricity for the city pumping station, municipal buildings, etc.

CANFIELD, OHIO—The village of Canfield is negotiating with the Mahoning & Shenango Railway & Light Company to extend its lighting service to Canfield.

CINCINNATI, OHIO.—Bids will be received by the Board of Education, Denton Building, Cincinnati, until May 22 for remodeling the Whittier School. Considerable electrical work will be required.

CINCINNATI, OHIO.—Plans suggested by the united boulevard lighting committees, representing various business organizations, for the installation of ornamental lamps in the business section have been approved by Service Director Hornberger, and the Union Gas & Electric Company has submitted a proposal for the installation of such a system, covering maintenance for six years, placing the cost at $150,000 more than the present system.

DAYTON, OHIO—The Dayton Power & Light Company has petitioned the State Public Utilities Commission for authority to issue $1,250,000 in bonds, the proceeds to be used for additions and betterments to its system.

DAYTON, OHIO.—Plans are being considered by the Cincinnati, Hamilton & Dayton Railway Company, to operate electric motor trains on the branch between Dayton and Mandale, running through Delphos and Spencerville.

DAYTON, OHIO.—Improvements involving an expenditure of from $50,000 to $75,000, including the construction of a new power plant is under consideration by the Cincinnati, Hamilton & Dayton Railway Company at Dayton.

DESHLER, OHIO.—An election will be held May 10 to submit to the voters the proposal to construct an electric-light plant and water-works system in Deshler.

HAMILTON, OHIO.—The Gamewell Fire Alarm Company has submitted a proposal to the City Council to remodel the present fire alarm system at a cost of $2,500. The system is inadequate and the cost of bringing it up to the efficiency desired is estimated at $12,000.

KENT, OHIO.—The Village Council has engaged an engineer to prepare plans for a municipal electric-light plant.

McCOMB, OHIO.—The Northwestern Light Company of Leipsic, it is reported, has been asked to submit proposals for supplying electricity in McComb. The city now operates a municipal electric plant.

MOUNT CARMEL, OHIO.—The Mount Carmel Electric Power & Light Company, recently incorporated with a capital stock of $3,000, is constructing an electric-light and power plant in Mount Carmel. Charles H. Ludlow is president.

READING, OHIO.—Bids will be received by the Board of Education until May 22 for the completion of the new Reading public school, including the electrical work. Separate bids to be submitted on different branches of the work. Plans and specifications are on file at the office of Garber & Woodward, architects, Cincinnati.

SPRINGFIELD, OHIO.—Plans have been prepared for the installation of the ornamental street lighting system, bids for which, it is understood, will soon be asked.

UHRICHSVILLE, OHIO.—A petition will be presented to the City Council asking that an election be called to submit to the voters the proposal to issue bonds for the installation of a municipal electric-light plant.

WELLSTON, OHIO.—The power station at one of the mines of the Superior Coal Company, near Wellston, was recently destroyed by fire, causing a loss of about $15,000. The plant will be rebuilt at once.

YOUNGSTOWN, OHIO.—The Youngstown & Niles Railroad Company has petitioned the State Utilities Commission for permission to issue $100,500 in capital stock for the construction of an electric railway between Youngstown and Warren.

FORT COVINGTON, KY.—The Fort Covington Light, Heat & Power Company is negotiating with a firm in Bombay, 5 miles distant, to furnish electricity. If the deal is closed it will necessitate the erection of 5 miles of transmission line. W. H. S. Keefe is manager.

HAZARD, KY.—Arrangements have been made whereby the Kentucky River Light & Power Company will furnish lighting service in Hazard.

MAYFIELD, KY.—The receivership of the Mayfield Water & Light Company has been dissolved and has been taken over by the owners. D. B. Stanfield has been appointed president and E. Gardner general manager.

PEMBROKE, KY.—Franchise have been secured by the Southern Kentucky Power Company of Pembroke to supply electricity in Elkton, Adairville, Auburn, Lewisburg and Frankline in Kentucky, and Adams, Cedar Hill and Portland, in Tennessee. S. A. Ragsdale is manager.

PIKEVILLE, KY.—Extensions are being made to the plant of the Sandy Valley Light & Power Company of Pikeville, including the installation of two Fort Wayne 100-kva., 60-cycle, 2300-volt alternators and two Russel engines, 14 in. by 16 in. (directly connected). The system is being changed from 220-volt, direct current to 2300/220/110 for light and power service. When improvements are completed a 24-hour service will be established. L. L. Stone is manager.

SARDIS, KY.—The electric-light plant installed in the Sardis Opera House by Albert Hill of Maysville will be used primarily to operate moving picture equipment. The plant has sufficient output to supply the town with electrical service.

SHELBYVILLE, KY.—Surveys have been completed and the right of way secured by the Shelbyville & Frankfort Realty Company for the construction of an electric railway between Shelbyville and Frankfort, via Bridgeport, Grafenburg, Peytona and Clayvillage, 19 miles in length. Overhead trolley will be used. Power stations will be located at Shelbyville and Frankfort. J. W. Gudgel of Shelbyville is secretary.

STITHTON, KY.—The property of the Stithton Lighting Company has been purchased by C. H. Aubrey and L. J. Metcalfe.

McCOOL, IND.—Contract for the erection of transmission line from McCool to connect with the lines of the Gary & Interurban Railroad Company to supply energy to operate the local system has been awarded to the T. G. Hamilton Company of Gary.

NORTH JUDSON, IND.—The North Judson Electric Company is installing about 100 lightning arresters on its old and new erected distributing lines. F. D. Pixa is secretary and treasurer.

PERU, IND.—Plans are being considered

by the City Council for extension of electrical service of the municipal electric-light plant to Bunker Hill. A. C. Herren is manager.

BELLEVILLE, ILL.—The City Council has approved plans for raising $350,000 for the construction of a municipal electric-light plant.

BERWYN, ILL.—The contract for the installation of an ornamental street-lighting system has been awarded to the T. G. Hamilton Company of Gary, at $32,000.

GALVA, ILL.—The Galva Electric Light Company is installing coal-handling conveyors and lightning arresters are being installed on each transformer for individual farm installation. All material has been purchased. E. O. Brown is vice-president and manager.

HARDIN, ILL.—The Town Council has granted Peter A. and Edward Gotway, Jr., a 50-year franchise to construct and operate an electric-lighting system in Hardin. Work will begin at once on construction of the plant, which will cost about $7,000.

MANCHESTER, ILL.—The installation of an electric-light system in Manchester is under consideration by the city officials.

ST. FRANCISVILLE, ILL.—The city of St. Francisville has recently completed the installation of a municipal electric-light plant. The equipment consists of one 75-hp. Muncie oil engine, one 37½-kw. Western Electric generator. Within the next 30 days the city expects to install an 80-hp. engine and a 50-kw. Western Electric generator for the purpose of maintaining a 24-hour service. F. D. Christian is engineer in charge.

UPPER ALTON, ILL.—Bids will be received by the State Board of Administration, Capitol Building, Springfield, until May 16, for power piping and accessories to be installed in the new power house at the Alton State Hospital, near Upper Alton. Plans and specifications may be obtained upon application to Martin C. Schwab, consulting engineer, Mallers Building, Chicago.

EAU CLAIRE, WIS.—The Wisconsin-Minnesota Light & Power Company has closed a contract to supply the Northern States Power Company with 40,000 hp. of electrical energy from the power plant now being built on the Chippewa River. A high-tension transmission line to transmit this energy to Minneapolis for distribution by the Minneapolis General Electric Company will be erected at a cost of about $700,000.

SUPERIOR, WIS.—Bonds to the amount of $10,000 have been voted for completion of the underground fire-alarm system.

BIRD ISLAND, MINN.—Bids will be received by H. M. Mielke, clerk independent school district No. 64 of Renville County, Bird Island, until May 22 for construction of a fire-proof school building, separate bids to be submitted as follows: General construction, heating and ventilating, plumbing, electrical work. Plans and specifications may be obtained on application to W. L. Alban, architect, Endicott Building, St. Paul, upon deposit of $10.

BLUE EARTH, MINN.—Bids will be received by Easton Floe, city clerk, Blue Earth, until May 10 for equipment for the municipal electric-light plant as follows: For furnishing and installing one 200-kva., alternating-current engine driven generating unit, one 100-kva. generator for direct connection to present engine; removing present direct-current generator; alternating-current switchboard, furnishing but not erecting, one feed water heater, oil separator and boiler feed pump. Plans and specifications may be obtained from Earle D. Jackson, consulting engineer, Capitol Bank Building, St. Paul.

BRAINERD, MINN.—The Brainerd Gas & Electric Company, recently incorporated with a capital stock of $100,000, it is reported, will soon begin work on the construction of a new plant. A. G. Whitney is president.

CANBY, MINN.—Bids will be received by Ole Ostensoe, clerk of board of education, consolidated school district No. 30, Yellow Medicine County, Canby, until May 11 for erection of a high school building and remodeling the present school building, separate bids to be submitted as follows: (A. B. C.) General construction; (D) Heating and ventilation; (E) Plumbing; (F) Electrical work. Plans and specifications may be obtained from Kirby T. Snyder, architect. Plymouth Building, Minneapolis, upon deposit of $25 on all plans, of which $15, will be returned on plans A. B. and C, and $20 on plans of D. E. and F.

HEWITT, MINN.—The Village Council has entered into a contract with the Otter Tail Power Company of Fergus Falls to supply electricity in Hewitt. The company, it is understood, will erect a transmission line from Wadena or Henning to Hewitt, and will also construct a line through Battle Lake.

HOUSTON, MINN.—The installation of an electric-light plant in Houston is under consideration.

ISANTI, MINN.—Plans are being considered for the installation of an electric-lighting system in Isanti. Energy to operate the system will be supplied by the Eastern Minnesota Power Company of Pine City.

PERHAM, MINN.—Bids will be received by Mike Goblirich, secretary of school board of school district, No. 44, Otter Tail County, City Hall, Perham, until May 15 for erection of a high school building and remodeling of an old high and grade school building. Separate bids to be submitted as follows: General construction, heating and ventilating, electrical work, science and laboratory equipment, gymnasium equipment, and seating. Plans may be obtained on application to G. L. Lockhart, architect, Endicott Building St. Paul, upon deposit of $10.

ROCHESTER, MINN.—The City Council is considering the installation of an ornamental lighting system on Main Street, to cost about $5,000.

ROCHESTER, MINN.—Bids will be received by the Masonic Temple Association, Rochester until May 12 for erection of a three-story fire-proof building, according to plans and specifications prepared by F. H. Ellerbe, architect, Endicott Building, St. Paul, Minn. Separate proposals to be submitted for wiring, heating and plumbing.

ST. PAUL, MINN.—Plans are being considered for the installation of an ornamental street-lighting system on Fourth Avenue.

ANTHON, IOWA.—A special election will soon be called to submit to the voters the proposal to issue $20,000 in bonds for the installation of a municipal electric-light plant.

BOONE, IOWA.—Bids will be received by the Board of Supervisors of Boone County, at the office of the County Auditor, Boone, until May 22, for construction of new court house and heating plant. Separate to be submitted on heating and plumbing, electric wiring, electric elevator and book lift. Plans and specifications are on file at the office of the County Auditor, Boone, at the office of Norman T. Vorse, architect, S. & L. Building, Des Moines, and the Builders' Exchange, Minneapolis, Minn. The plans which are now on file are the same upon which bids were received April 14, and which were rejected on account of the advertisement being illegal.

GRINNELL, IOWA—Plans are being prepared by the Iowa Light, Heat & Power Company of Cedar Rapids for the construction of a new plant, to cost about $100,000, in Grinnell.

IOWA CITY, IOWA.—The Iowa City Light & Power Company has practically completed the installation of a 1000-kw. General Electric horizontal turbine and complete new switchboard, 200-hp. Babcock & Wilcox boilers pumps, blowers, etc., and is now installing a 300-kva. generator (vertical) directly connected to a Leffel turbine. L. E. Caldwell is manager.

IOWA CITY, IOWA.—The farmers in Sharon and Washington Townships of Johnson County have organized for the purpose of securing electrical service in that district. It is proposed to erect a transmission line (about 30 miles long) at a cost of about $300 per mile. Electricity to operate the system will be secured either from the Iowa City Light & Power Company or the Iowa-Cedar Rapids Interurban Company.

MUSCATINE, IOWA.—The stockholders of the Muscatine North & South Railway Company have decided to reorganize the company and to equip the railroad for electrical operation to convert it into an interurban line to run under a traffic arrangement as a continuation of the Davenport & Muscatine Railway. E. H. Ryan is president of the company.

NORA SPRINGS, IOWA.—The Nora Springs Electric Light & Mill Company it is reported, contemplates extending its transmission lines to Maple City to supply electrical service there. The company has applied for a franchise to install a distributing system in that city.

OUASQUETON, IOWA.—A franchise has been granted to J. L. Croos to construct and operate an electric-light plant in Quasqueton. Mr. Cross has an option on a water power site and will build a hydroelectric plant. It is also proposed to erect a transmission line from this city to Walker.

RANDOLPH, IOWA.—The citizens have voted to install a municipal electric-lighting system and to enter into a contract with the Malvern (Iowa) Light & Power Company to supply energy to operate same. Bonds to the amount of $4,500 have been authorized for the plant.

ROCK RAPIDS, IOWA.—Bids will be received by E. J. Riegel, county auditor, Rock Rapids, until May 24, for furniture and fixtures for new court house as follows: (1) Steel furniture and fixtures; (2) Wood furniture and fixtures; (3) Electrical fixtures and equipment. Plans and specifications may be obtained upon application to the county auditor upon deposit of $25 for each set.

AURORA, MO.—The Lawrence County Light, Power & Cold Storage Company of Aurora has entered into a contract with the Union Mining Company of Aurora to equip its properties for electrical operation.

PRINCETON, MO.—The City Council is considering calling an election to submit to the voters the proposal to issue $12,000 in bonds for improvements to the municipal electric-light and water plants.

MINOT, N. D.—The Northern States Power Company of Chicago, Ill., which owns and controls the Consumers' Power Company of St. Paul, Minn., contemplates extending its transmission line from Burlington to Foxholm, taking in the territory of Des Lacs and Berthold; is also considering installing electrical systems in Syrreu, Logan and other towns in this section of the state.

TOWNER, N. D.—Application has been made to the City Council by C. B. Aasness and J. E. Galehouse of Carrington for a franchise to install and operate an electric-light plant in Towner.

MARION, S. D.—Work has begun on the construction of the new power station and electric-lighting system in Marion.

REDFIELD, S. D.—At an election held April 18 the proposal to issue $60,000 in bonds for the construction of a new municipal light, heat and power plant was carried. L. W. Hase is superintendent of the municipal electric-light plant.

SIOUX FALLS, S. D.—At an election held recently the proposal to issue $700,000 in bonds for the construction of municipal electric-light and gas plants was defeated.

BANCROFT, NEB.—At an election held recently the proposal to issue bonds for the installation of a municipal electric-light plant was carried.

FAIRBURY, NEB.—The Fairbury Electric Lighting Company is negotiating with the Plymouth, Daykin & Western Company to supply electricity.

KEARNEY, NEB.—The State Railway Commission has granted the Kearney Electric Light & Power Company permission to issue $200,000 in bonds.

OMAHA, NEB.—The cost of installing elevators in the City Hall is estimated at $28,200. For further information address city clerk.

TRENTON, NEB.—Bonds to the amount of $8,500 have been voted to establish a municipal electric-light plant in Trenton.

CANEY, KAN.—The Caney Electric Light & Railway Company is now installing a 150-hp. Weber gas engine and a 120-kva., 60-cycle, 2300-volt generator. J. E. Roquette is manager.

EUDORA, KAN.—The city of Euroda is planning to install an electric distributing system. Energy to operate the system will be obtained from the plant at Bonner Springs.

GARDEN CITY, KAN.—At a special election held recently the proposal to issue $41,500 in bonds for the purchase of the electric-light plant of the Garden City Telephone, Light & Manufacturing Company and the erection of a transmission line from the city power plant of the Garden City Sugar & Land Company was defeated.

GYPSUM, KAN.—The Gypsum Light & Power Company is contemplating the erection of 15 miles of transmission line and will use 30 or 35-ft. poles, probably iron or steel conductors; will also need 13,200-volt insulators, lightning arresters and transformers, sizes from 1 to 25 kva. J. F. Keys is manager.

HARDTNER, KAN.—A franchise has been granted to E. Watson of Hardtner to furnish electricity here for commercial purposes.

LEWIS, KAN.—At an election to be held May 9 the proposal to issue $10,000 in bonds for the installation of an electric distributing system in Lewis and construction of transmission line to secure energy from the electric plant, owned by A. L. Moe, Kinsley, will be submitted to the voters.

NORTON, KAN.—The city of Norton is contemplating extending its transmission lines to Lenora and Nocatur to furnish electrical service from the municipal electric plant in those towns.

OSBORNE, KAN.—Bonds to the amount of $7,000 have been voted for improvements to the municipal electric-light plant. The installation of a new engine is contemplated.

E. T. Archer & Company, New England Building, Kansas City, Mo., are engineers.

OTTAWA, KAN.—Bids will be received at the office of the city clerk, Ottawa, until May 15 for furnishing material and equipment for the municipal electric-light plant as follows: One (or possibly two) two-phase, 60-cycle generator with a maximum rating of 350 kw., together with a suitable steam prime mover to operate at 130 lb. pressure; one (or possibly two) surface condenser for the above unit complete with necessary auxiliaries, one switchboard complete, to care for three two-phase generators with their exciters and eight feeders, spray nozzle equipment for cooling the circulating water for the above condenser. Plans and specifications are on file in the office of George C. Shaad, consulting engineer, Lawrence, Kan., and at the office of the city clerk, Ottawa. Copies of plans may be obtained on application to the city clerk upon deposit of $5.

SALINA, KAN.—Extensive additions and improvements are under way at the plant of the Salina Light, Power & Gas Company, including the enlargement and remodeling engine and boiler rooms, installation of one 1250-kw. turbine and auxiliaries, two 400-hp. Stirling boilers and stokers, one 2000-hp. feed water heater, one 25-kw. turbine-driven exciter, condenser (2000 sq. ft.), 1800-ft. double pipe line (16-in. pipe), to river for condensing water and two centrifugal pumps with motors. All material has been purchased. J. E. Harsh is general manager.

Southern States

CHAPEL HILL, N. C.—Bids, it is understood, will be asked for by the J. B. McCrary Company, engineer, Atlanta, Ga., for the installation of construction of a new lighting and heating plant for the University of North Carolina, to cost about $50,000.

FOREST CITY, N. C.—The Southern Power Company of Charlotte, it is reported, has signed a contract whereby it will extend its transmission line into Rutherford County. The line, it is understood, will run direct from Gaffney to Henrietta, thence to Caroleen, Forest City and Rutherfordton, all places having contracted for energy.

CHARLESTON, S. C.—Application has been made to the City Council by J. P. Wood, acting for the Charleston Electric Service Company (not yet formed) to supply electricity for lamps and motors in Charleston.

SALUDA, S. C.—The Saluda Public Service Company, recently incorporated with a capital stock of $25,000, proposes to build an electric-light and power plant in Saluda. T. D. Fulmer and E. W. Abele are interested.

SPARTANBURG, S. C.—The Southern Railway Company is planning to erect substations at Spartanburg and Central, S. C., and Cornelia, Ga., and electric generating equipment will be installed in the power station at Greenvile, S. C., to supply electricity to operate the automatic block signals and lighting station between Spartanburg and Central and Cornelia and Gainesville. W. H. Wells of Washington, D. C., is chief engineer.

SUMMERVILLE, S. C.—The property of the Summerville Ice & Power Company has been purchased by the Carolina Central Electric Company. The new owners, it is understood, will enlarge the plant.

ATLANTA, GA.—The Georgia Railway & Electric Company, leased by the Georgia Railway & Power Company of Atlanta, is contemplating extending its Inman Park line from Moreland, through Moreland and the Briar Cliff Road to the Fulton-DeKalb County line, thence to Emory University.

PENSACOLA, FLA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 6 for furnishing and installing an electric freight elevator at the naval aeronaut station, Pensacola.

PORT ST. JOE, FLA.—Plans, it is reported, are being considered for equipping the Apalichicola Northern Railroad for electrical operation.

FRIENDSHIP, TENN.—Plans are being considered by W. H. Fisher, manager of the local electric-light plant to install additional equipment in the electric plant, to meet the increasing demand for electrical service.

McMINNVILLE, TENN.—The County Court has granted the Great Falls Power Company of Chattanooga permission to construct a dam at Caney Fork Falls.

MURFREESBORO, TENN.—The property of the Murfreesboro Electric Light & Gas Company has been purchased by J. M. and John Butler and J. C. and George Beesley.

ANNISTON, ALA.—Preparations are being made by the Alabama Power Company to double the output of its substation in Anniston.

BIRMINGHAM, ALA.—Surveys are being made for the proposed electric railway from Birmingham to Warrior River and on to Jasper by the Birmingham Interurban Development Company. The work will be done under the supervision of C. J. Rogers, engineer.

BIRMINGHAM, ALA.—The new steam generating plant of the Alabama Power Company will be located at Baker Creek on the Black Warrior River, about 2 miles from the present terminus of the Drifton branch of the Southern Railway. Extensions will also be made to the high-tension transmission system of the company and an additional generating unit will be installed at the power plant at Lock 12 on the Coosa River.

GOODMAN, MISS.—The city of Goodman has engaged Xavier A. Kramer, of Magnolia, consulting engineer, to prepare plans for an electric-light plant, to cost about $5,000.

ITTA BEND, MISS.—The town of Itta Bend, has purchased the local electric-light plant, owned by J. L. Haley, for $4,250.

MAGNOLIA, ARK.—The Arkansas Light & Power Company is enlarging the boiler house of its local plant and is installing a 66-in. by 16-ft. Houston, Stanwood & Gamble boiler. L. C. Marshall is local manager.

MOUNTAIN HOME, ARK.—The Mountain Home Electric Light Company is contemplating the installation of a larger plant and supplying Cotter, 12 miles distant, with electrical service. Electricity will be supplied in Gassville, between the two towns and also to residents along the line.

WARREN, ARK.—Plans are being considered for the installation of an electric-light plant in Warren. L. J. Burbridge is interested.

LA FAYETTE, LA.—A special election will be held May 2 to submit to the voters the proposal to issue $10,000 in bonds, of which the proceeds of $20,000 will be used for improvements to fire protection and alarm system.

WEST MONROE, LA.—At an election to be held May 18 the proposal to issue $45,000 in bonds for extensions to electric-lighting system, water-works, to install filter plant and to install additional apparatus for fire protection.

COWETA, OKLA.—Plans are being considered for the purchase of an additional generating unit at the municipal electric-light plant and the construction of an ice factory.

CROWDER, OKLA.—The Canadian Valley Ice, Light & Fuel Company, recently organized, proposes to erect and operate an electric transmission line, connecting Crowder, Canadian, Indianola and Hanna, 2 miles long. Contracts for materials have been awarded. R. A. White is manager.

KUSA (Not a post office), OKLA.—Plans are being prepared by the Kusa Ice, Light & Power Company for the installation of an electric-light plant and ice factory. The equipment will include a 100-kw. generator driven by oil or steam engine, switchboard, etc. The ice plant will have a capacity of 30 tons. Roscoe G. Clark, Republic Building, Kansas City, Mo., is interested.

McALESTER, OKLA.—The property of the Choctaw Railway & Lighting Company has been purchased by C. M. Mason, chairman of the bondholders' protective committee of New York for $450,000. Improvements will be made to the plant including the installation of new machinery.

NEW WILSON, OKLA.—Bids will be received by the Board of Trustees of New Wilson until May 3 for construction of electric-light plant and water-works system, including power house, equipment, distribution system, etc. The Benham Engineering Company, Colcord Building, Oklahoma City, Okla., are engineers.

HOUSTON, TEX.—Bids will be received by E. E. Sands, city engineer, Houston, until May 10 for one electrically-driven traveling crane for wharf and four traveling cranes for sewage disposal plants, to cost $8,000 and $7,000 respectively.

McKINNEY, TEX.—The Texas Power & Light Company of Dallas, Tex., has purchased the municipal electric plant and the electric property of the McKinney Ice, Light & Coal Company in McKinney. Both systems will be connected with the present transmission and distributing systems of the Texas Company.

MERTZON, TEX.—A new power station will be erected for the local electric-light plant, replacing the present building. R. M. Wooley is interested.

WACO, TEX.—Preparations are being made to double the power plant of the Texas Power & Light Company at East Waco. A contract has been awarded for the installation of four 600-hp. boilers.

Pacific States

ELMA, WASH.—The property of the Elma Light & Power Company has been purchased by the Northwest Electric & Water Works of Montesano. The consolidation of the two plants means electrical service for all the valley farms and for commercial purposes in Satsop. Extensions and improvements, it is understood, will be made to both plants. R. J. Andrus of Montesano, general manager of the Northwest Electric & Water Works, will have general supervision of both plants.

LA CROSSE, WASH.—The Commissioners of Whitman County have granted Harry G. Wilson a franchise to construct and operate an electric-light system in the town of Lacrosse for a period of 25 years.

LIND, WASH.—The Washington Water Power Company of Spokane contemplates extending its electrical service to the experimental farm, 3 miles from Lind.

SUNNYSIDE, WASH.—The Pacific Power & Light Company of Portland, Ore., has applied to the Board of Commissioners of Yakima County for permission to erect transmission lines and make a number of extensions to its systems in this vicinity.

BAKER, ORE.—The construction of an electric railway from Pine, 45 miles long, and from Baker to Eagle Valley, a distance of 75 miles, is under consideration. Alexander Allerdyce is interested.

GRANTS PASS, ORE.—Plans for the installation of a hydro-electric generating plant, on Fiddler's Gulch in the Kirby district, near Grants Pass, to supply electricity at the Black Eagle Group of mining claims is reported to be under consideration. William H. Swalwell of Everett, Wash., is reported to be interested in the mines.

PORTLAND, ORE.—Plans are being worked out by W. H. Daly, commissioner of department of public utilities, and engineers of the municipal water bureau, providing for the installation of a municipal electric-lighting plant. Tentative plans call for the construction of a hydro-electric power plant on Bull Run River, in connection with an impounding dam which will soon be necessary for the conservation of the city water supply. It is estimated that about 4000-hp. can be developed at a cost of about $200,000.

RIDDLE, ORE.—The installation of an electric-light plant in Riddle is under consideration. A. E. Braise is reported interested in the project.

WALDPORT, ORE.—The installation of an electric-lighted plant in Waldport is under consideration. L. H. Evans is interested.

FONTANA, CAL.—The Fontana Power Company, recently organized with a capital stock of $350,000, contemplates the development of a water power in the mountains to supply power in the Fontana district and adjacent territory. A. B. Miller, R. H. Bassler of Fontana, and others, are interested in the company.

PASADENA, CAL.—Bids have been asked by the City Commission for extra equipment, amounting to $15,000, for the municipal electric-light plant.

REDDING, CAL.—At an election held recently the proposal to install a municipal electric-light plant was carried.

SACRAMENTO, CAL.—The Clear Lake Suspended Monorail Company, recently incorporated with a capital stock of $50,000, proposes to construct a railway (suspended monorail type) from Sacramento to Lakeport, a distance of 24 miles. L. H. Briggs of Kelseyville is one of the directors.

ALBION, IDAHO.—Work will soon begin on the installation of the electric-lighting system in this city. The directors of the Albion Normal School are contemplating heating the building with electricity.

LAVA HOT SPRINGS, IDAHO.—The Utah Power & Light Company of Salt Lake City, Utah, has applied to the Public Utilities Commission for permission to furnish electricity for lamps and motors in the village of Lava Hot Springs and Bancroft.

LEWISTON, IDAHO.—The construtcion of a large hydro-electric power plant has been recommended to the City Council by Mayor J. E. Hoobler. It is proposed to ask nearby cities to join in the enterprise.

MONTICELLO, UTAH.—The citizens have voted to install an electric-light plant and water works system. The Blue Mountain Irrigation Company is reported to be back of the project.

PRICE, UTAH.—A special election will be held May 15 to submit to the voters the proposal to sell the municipal electric-light plant. It is proposed to secure energy from the Utah Power & Light Company of Salt Lake City.

BUTTE, MONT.—Work is being rushed on the construction of the new Holter hydroelectric development of the Montana Power Company, which will be completed not later than August, 1917. In addition to this the company has plans under way for the construction of another large power plant at one of its sites.

LAMAR, COL.—Improvements involving an expenditure of $100,000 are contemplated by the Intermountain Railway, Light & Power Company.

ALAMOGORDO, N. M.—Bonds to the amount of $300,000 have been voted, of which the proceeds of $25,000 will be used for the purchase of the local electric-light plant and the remainder to take over the water-works system.

SANTA FE, N. M.—Estimates have been filed with the State Engineer by the Rio Grande Light, Heat & Power Company for the proposed development at the mouth of White Rock Canyon. C. G. Wilfong is president of the company.

Canada

VANCOUVER, B. C.—Steps have been taken by the management of the Granby Consolidated Mining, Smelting & Power Company of Vancouver for the construction of an auxiliary plant of from 7000 to 8000 hp. at its Hidden Creek property. Contracts for machinery, it is understood, will soon be placed.

OTTAWA, ONT.—Tenders will be received by R. C. Desrochers, secretary department of public works, Ottawa, until May 15 for 10 knots of single-conductor submarine telegraph cable (107 lb. copper and 150 lb. gutta percha per knot) with sheathing of 12 No. S.W.G. iron wires, to be delivered at Halifax, N. S., within eight weeks after date of acceptance of tender. Specifications may be obtained on application to the general superintendent of the government telegraph service at the Department of Public Works, Ottawa.

TORONTO, ONT.—Preparations are being made by the Ontarion Hydro-Electric Commission to begin work on the proposed power canal from Chippewa Creek to Queenstown.

Record of Electrical Patents

Notes on United States Patents issued April 18, 1916, prepared by Mitchell & Allyn, 41 Park Row, New York.

1,179,389. CIRCUIT-CONTROLLING DEVICE; J. T. Austin, Hartford, Conn. App. filed March 2, 1915. Particularly for obtaining crescendo effects in organs.

1,179,395. INSULATING SUPPORT FOR STORAGE-BATTERY TANKS; H. M. Beck, Evanston, Ill. App. filed Nov. 27, 1912. Fragile wall of cup containing insulating liquid is protected.

1,179,409. SURVEYOR'S RANGE FINDER; C. P. Donnell, Sequim, Wash. App. filed July 19, 1915. Flash lamp slidably mounted on range-finding staff.

1,179,455. GROUND CLAMP; H. W. Pleister, Westfield, N. J. App. filed May 11, 1911. Struck up out of a flat plate.

1,179,478. ELECTRIC BRAKING SYSTEM; P. S. Turner, Chorlton-cum-Hardy, England. App. filed May 22, 1913. Motor-braking circuit is automatically started as car starts to back down hill.

1,179,495. TRANSFORMING BATTERY; Anton Burkardt, New York, N. Y. App. filed Feb. 20, 1915. Wet cells transform alternating current into direct current.

1,179,498. COMBINED TERMINAL BOX AND SWITCH SUPPORT; C. H. Bissell, Syracuse, N. Y. App. filed June 22, 1911. Closed construction to prevent ignition of gases.

1,179,502. BATTERY AND LAMP TESTER; W. F. Cass, Escanaba, Mich. App. filed March 27, 1915. Adjustable to quickly test flashlight batteries of different sizes.

1,179,515. ALTERNATING-CURRENT RECTIFIER; L. E. France, Cleveland, Ohio. App. filed March 4, 1915. Vibrating type requiring no outside source of direct current.

1,179,517. TELEGRAPH INSTRUMENT; E. L. Gilleland, Grand Forks, N. D. App. filed Feb. 4, 1915. Eliminates need for usual open circuit and sounder.

1,179,522. PROCESS OF EXTRACTING METALS FROM THEIR ORES; W. E. Greenawalt, Denver, Col. App. filed Sept. 30, 1912. Realizes pure deposited metal direct from the ore solvent.

1,179,530. DIRECT-ACTING SOLENOID RESISTANCE REGULATOR FOR TRAIN-LIGHTING SYSTEMS; P. Kennedy, Brooklyn, N. Y. App. filed July 6, 1912. Makes possible the use of a small, compact solenoid.

1,179,545. WIRE-WRAPPING MACHINE; T. Midgley, Worthington, Ohio. App. filed March 18, 1914. Utilizes aspiral wrapping of tape.

1,179,624. OVERLOAD INDICATOR; C. F. Gilliatt, Lynn, Mass. App. filed Jan. 11, 1909. Will operate under a heavy current without injury.

1,179,637. CIRCUIT CONTROLLER; C. J. Kruse, Cleveland, Ohio. App. filed Jan. 5, 1911. Operates on failure of voltage in any phase.

1,179,642. TELEPHONE ATTACHMENT; J. F. Makowski, Berkeley, Cal. App. filed Aug. 14, 1913. Special support for the receiver.

1,179,700. TAKE-UP DEVICE FOR TELEPHONE CORDS; W. P. Cornell, Charleston, S. C. App. filed July 13, 1914. Spiral spring attached directly to telephone cord.

1,179,722. LIGHTNING ARRESTER; W. J. Heinritz, Norristown, Pa. App. filed July 23, 1915. Magnet shifts one of the horns to increase the air gap.

1,179,728. SEPARABLE ATTACHMENT PLUG; G. P. Knapp, Bridgeport, Conn. App. filed Jan. 11, 1915. Constructed to prevent short-circuiting and has a grounding connection.

1,179,741. AUTOMATIC TELEPHONE SYSTEM; G. E. Mueller, Aurora, Ill. App. filed April 13, 1907. Switches for conversation circuit has single set of wrappers. (Fifty-one claims.)

1,179,769. STREET INDICATING MECHANISM; T. W. Small, Cleveland, Ohio. App. filed July 16, 1910. Direction of feed of web is electrically reversed.

1,179,770. STREET INDICATING MECHANISM; T. W. Small, Cleveland, Ohio. App. filed Jan. 9, 1913. Automatically reversed at the end of each trip.

1,179,779. STARTING AND LIGHTING SYSTEM; H. W. Uhl, Freeport, N. Y. App. filed Nov. 10, 1914. Motor attains speed before turning engine, without mechanical clutches.

1,179,783. BOND WIRE PROTECTOR; E. W. Vogel, Oak Park, Ill. App. filed May 2, 1914. Plug carrying a heavy wire which overlies the bond wire.

1,179,805. ELECTRIC REGULATION; J. L. Creveling, New York, N. Y. App. filed Sept. 29, 1911. Special arrangement for car lighting systems.

1,179,872. CONNECTOR FOR ELECTRIC WIRES; C. E. Stromquist, Coffeyville, Kan. App. filed March 6, 1915. Wide clip constructed to receive wire ends.

1,179,878. TROLLEY RETRIEVER; F. A. Wasson, Milwaukee, Wis. App. filed May 12, 1913. Utilizes compressed air from the brake system.

1,179,891. ELECTRIC SWITCH; T. Bozzetti, Turin, Italy. App. filed March 27, 1915. Single push-button construction.

1,179,903. ELECTRIC BATTERY; F. S. B. DeMello, Rio De Janiero, Brazil. App. filed Feb. 23, 1916. Depolarizer of artificial protosulfid of copper.

1,179,906. ELECTRIC SIGNALING; R. A. Fessenden, Brant Rock, Mass. App. filed June 16, 1908. Microphonic material between diaphragm and fixed plates statically attracted thereby.

1,179,927. DEVICE FOR PRODUCING OXIDS OF NITROGEN; J. S. Island, Toronto, Ontario, Canada. App. filed Oct. 4, 1913. Annular sheets of electric flames produced between stationary and rotating electrodes.

1,179,929. DEVICE FOR BREAKING CIRCUIT BETWEEN GENERATOR OR MAGNETO AND STORAGE BATTERY; S. F. Johnson, Indianapolis, Ind. App. filed Feb. 25, 1915. Brush is automatically lifted off commutator when speed is reduced.

1,179,933. ELECTRIC CIRCUIT CONTROLLING MECHANISM; S. Q. Kline, Jr., Washington, D. C. App. filed April 13, 1915. Particularly for indicating level of water at a distant point.

1,179,936. ELECTROSTATIC APPARATUS FOR SEPARATING AND CLEANING GRITS, GRAIN OR THE LIKE; J. Kraus, Brunswick, Germany. App. filed July 10, 1913. Stationary dielectric covers electrode of the attracted pole.

1,179,937. METHOD OF AND APPARATUS FOR SEPARATING AND CLEANING MATERIALS IN AN ELECTROSTATIC FIELD; J. Kraus, Brunswick, Germany. App. filed Feb. 2, 1915. Poles and the septum are shifted relatively to each other.

1,179,957. SWITCH MECHANISM FOR CONTROLLING CIRCUITS OF HIGH CURRENT VALUE; G. E. Palmer, Newton, Mass. App. filed Feb. 8, 1915. Repeater switches for fire-alarm or like systems.

1,179,970. SIDE CONNECTION FOR ELECTRICAL CABLES; J. C. Stearns, Worcester, Mass. App. filed July 22, 1915. Particularly for the side lights on automobiles.

1,179,986. ELECTRICAL COOKING UTENSIL; A. A. Warner, New Britain, Conn. App. filed Oct. 1, 1913. Grill having special holder heater and food receptacle.

1,179,987. SIGNAL SYSTEM FOR RAILWAY CROSSINGS; E. M. Weaver, Ozone Park, N. Y. App. filed Oct. 31, 1908. Sounds alarms before and after train reaches and passes crossing.

1,180,039. ELECTRIC GENERATOR REGULATOR; W. Hill and J. B. Dyer, Anderson, Ind. App. filed Feb. 27, 1913. Switching device serves according to its speed to regulate magnetizing effect of generator windings.

1,180,044. SYSTEM OF ELECTRICAL DISTRIBUTION; M. H. Johnson, Utica, N. Y. App. filed Dec. 26, 1911. Battery and ignition systems controlled by a single means.

1,180,047. ELECTRIC RIVETING APPARATUS; F. P. Kobert, Milldale, Conn. App. filed May 25, 1915. Especially for riveting plates together.

1,180,048. ELECTRIC RIVETING APPARATUS; F. P. Kobert, Milldale, Conn. App. filed May 25, 1915. Has vertical plunger and operates like ordinary power press.

1,180,055. RAIL JOINT; S. Leschziner, Newark, N. J. App. filed March 19, 1913. Tenon pins unite rail ends to prevent settling.

1,180,075. PRODUCTION AND DETECTION OF ELECTRIC OSCILLATIONS; P. Pichon, Sudende, Near Berlin, Germany. App. filed June 25, 1907. For testing wireless signaling stations.

1,180,090. ELECTROLYTIC DEVICE FOR USE IN ELECTRIC METERS AND OTHER APPARATUS; W. B. Thrope, Wandsworth Common, London, England. App. filed Aug. 10, 1914. Operates by electrolytic evolution of gas.

1,180,096. APPARATUS FOR ELECTRIC WELDING; H. R. Woodrow and T. E. Murray, New York, N. Y. App. filed Jan. 12, 1916. Especially for welding tubular spokes to spoke faces.

1,180,103. APPARATUS FOR CONTROLLING ELECTRICAL CIRCUITS; R. E. Baker, Cleveland, Ohio. App. filed Nov. 25, 1912. Particularly for automatic regulating devices.

1,180,144. ELECTRIC WARP STOP MOTION; J. Hancq, Jamestown, N. Y. App. filed March 27, 1915. Heddle frame having improved channel flanges and rails.

1,180,147. COMBINATION TELEPHONE; R. D. Hatch, Memphis, Tenn. App. filed March 15, 1915. Combines in one instrument both the transmitter and receiver.

1,180,159. INCANDESCENT ELECTRIC LAMP; I. Langmuir, Schenectady, N. Y. App. filed April 19, 1913. Tungsten filament in dry nitrogen under pressure.

1,180, 174. REFRIGERATOR ALARM; W. I. Moon and D. Hackmann, Baltimore, Md. App. filed Nov. 28, 1914. Special construction for running over of drip water.

1,180,208. ELECTRIC SWITCH; G. B. Thomas and E. Anderson, Bridgeport, Conn. App. filed March 6, 1913. Key, socket, cam and contact mechanism.

1,180,216. FLOAT-OPERATED CIRCUIT CLOSER; L. L. White, Spokane, Wash. App. filed Oct. 26, 1915. Short-circuits magneto to stop engine when oil runs dry.

1,180,218. SIGNAL AND STOPPING MECHANISM FOR RAILWAY CARS; F. C. Williams, Philadelphia, Pa. App. filed April 11, 1910. Special arrangement of normally opened and closed controlling circuits.

1,180,232. BANDING MACHINE; A. J. Brown, Milwaukee, Wis. App. filed May 15, 1911. For wrapping banding wire about rotors of large machines.